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Final Supplemental Environmental Impact Report/
Environmental Impact Statement

Bel Marin Keys Unit V Expansion of the Hamilton Wetland Restoration Project

April 2003

California State Coastal Conservancy

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The study report provides a general reevaluation of the Hamilton Wetland Restoration Project Authorized in WRDA 1999 anc identifies a feasible expansion of the project. The expanded project comprises the beneficial re-use of 24.4 million cubic yards of dredged material to restore a total of 2,526 acres of seasonal and tidal wetland habitat for endangered species on the enlarge 2,600 acre project site which fringes San Pablo Bay, California. Provides for beneficial rescue of the greatest quantity of dredg material and provides critical endangered species habitat in the shortest amount of time.

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Bel Marin Keys Unit V Expansion of the Hamilton Wetland Restoration Project

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Bio Quest Wildlife Photography and Consulting. 2002. Joe Didonato, photography credit for cover photographs of salt marsh harvest mouse and California Clapper Rail, Alameda, CA.

FINAL
SUPPLEMENTAL ENVIRONMENTAL IMPACT REPORT/ ENVIRONMENTAL IMPACT STATEMENT (SEIR/EIS)

Bel Marin Keys Unit V Expansion of the Hamilton Wetland Restoration Project
Novato, Marin County, California

The responsible federal lead agency is the U.S. Army Corps of Engineers, San Francisco District (Corps). The responsible state lead agency is the California State Coastal Conservancy (Conservancy). The San Francisco Bay Conservation and Development Commission (BCDC) is a cooperating agency.

Abstract: This report describes and analyzes the potential environmental effects of proposed restoration of tidal salt marsh and other wetland habitat at the Bel Marin Keys Unit V (BMKV) property as an expansion of the Hamilton Wetland Restoration Project (HWRP). The final EIR/EIS for the HWRP was issued in 1998, and the project was authorized in the federal Water Resources Development Act (WRDA) of 1999. The Conservancy purchased the BMKV site in 2001 with the intent of proposing restoration on the site. This report will support decision making by the Corps, Conservancy, and other responsible agencies to implement the proposed expansion and to ensure compliance with the National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA), and other pertinent laws and regulations. The Final SEIR/EIS consists of two volumes: one volume contains the text of the SEIR/EIS, as revised, and the appendices; a second volume contains the comments received on the Draft SEIR/EIS and the responses.

The purpose of the BMKV expansion is to restore important tidal wetland habitat in San Francisco Bay and restoration at the BMKV site represents the implementation of local, regional, and national planning efforts. Three alternatives are analyzed in this document: Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond; Revised Alternative 2 – Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond; and Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond. The alternatives include restoration of tidal and other wetland habitats, construction and improvement of levees, installation of new water conveyance structures, and construction of a recreational trail, among other elements. The environmental consequences of each alternative are discussed. Where significant impacts are identified, mitigation is proposed where feasible mitigation has been identified. The Corps and the Conservancy have selected revised Alternative 2 as the preferred alternative, which is also the environmentally superior alternative.

Federal, state, and local agencies and the public will have an opportunity to comment on this document during a 30-day comment period. Information on the project can be found on the Internet at http:// www.coastalconservancy.ca.gov/belmarin. The document is also available at the City of Novato downtown library, Marin County central library.

FOR FURTHER INFORMATION: Questions and/or written comments about the proposed action and Final SEIR/EIS can be addressed to:

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Contents

Executive Summary **ES-1**

Project Overview ES-1
Separate Remedial Processes ES-2
Goal and Objectives ES-3
Project Goal ES-3
Project Objectives ES-3
Restoration Alternatives ES-4
Environmental Consequences ES-6
Significant Unavoidable Effects ES-6
Irreversible and Irretrievable Commitment of Resources ES-7
Relationship between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity ES-7
Public Issues, Public Involvement, and Areas of Controversy ES-8
Selection of the Preferred Alternative ES-11
Diverse Array of Habitats ES-12
Management Considerations ES-12
Beneficial Use of Dredged Material ES-13
Site Opportunities and Constraints ES-13
No Net Loss of Wetland Habitat at the BMKV and HAAF Sites ES-15
Creation and Maintenance of Wetland Habitats that Support Bay Area Special-Status Species ES-15
Buffers between Wildlife and Adjacent Land Uses ES-16
Compatibility with Adjacent Land Uses and Wildlife Habitats ES-17
Public Access Compatible with Protection of Resource Values ES-17

Chapter 1 Introduction **1-1**

Overview of the Proposed Wetland Restoration 1-1
State and Federal Agency Sponsors 1-2
Overview of the National Environmental Policy Act and the California Environmental Quality Act 1-2
Public Involvement and Scoping 1-4

Project Scoping 1-4
Distribution and Review of the Draft SEIR/EIS 1-5
Final SEIR/EIS 1-5
Intent and Scope of this SEIR/EIS 1-6
Intent 1-6
Scope 1-6
List of Local, State, and Federal Permits 1-7

Chapter 2 Purpose and Need 2-1

Statutory Authority 2-1
Purpose and Need 2-2
Goal and Objectives 2-3
Project Goal 2-3
Project Objectives 2-3
Relationship of the Proposed Bel Marin Keys Unit V Expansion to other Projects and Plans 2-4
Hamilton Wetland Restoration Project 2-4
San Francisco Bay Plan 2-5
Long-Term Management Strategy for Disposal of Dredged Sediments in San Francisco Bay 2-6
San Francisco Estuary Project Comprehensive Conservation and Management Plan 2-6
Ecosystem Restoration Program Plan 2-7
San Francisco Estuary Baylands Ecosystem Goals Project 2-7
Marin Countywide Plan 2-8
City of Novato General Plan 2-8
Bay Trail Plan 2-9
Oakland Harbor Navigation Improvement (50-Foot) Project 2-9
Defense Base Closure and Realignment Act of 1988 2-9
Formerly Used Defense Site Remediation at SLC Parcel 2-10

Chapter 3 Description of Alternatives 3-1

Introduction and Summary 3-1
Alternatives Under Consideration 3-5
No-Action Alternative 3-5
Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond 3-5
Revised Alternative 2 – Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond 3-20
Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond 3-30
Comparison of Restoration Alternatives 3-37

Alternatives and Alternative Features Dismissed from Further Consideration ... 3-40
Alternative 4 – Varying Habitat Mosaics ... 3-42
Alternative 5 – "Historic" Bay/Wetland Restoration ... 3-43
Alternative 6 – Hybrid of Dredged Material and Natural Sedimentation Approaches ... 3-43
Alternative 7 – Smaller Restoration Project ... 3-43
Alternative Feature 8 – Alternative Bay Trail Route ... 3-44
Alternative Feature 9 – Alternative Novato Sanitary District Wastewater Alignments ... 3-44
Alternative Feature 10 – In-Kind Replacement of Agricultural Wetlands ... 3-45
Alternative Feature 11 – Extend Tidal Reach to Pacheco Pond ... 3-46
Alternative Feature 12 – Removal of Berm Separating BMKV and HAAF ... 3-47
Alternative Feature 13 – Alternative Breach Location on Novato Creek ... 3-47
Alternative Feature 14 – Reclaimed Wastewater Alternative ... 3-47
Alternative Feature 15 – Single Large-Basin, Single-Breach Alternative ... 3-47
Alternative Feature 16 – Flood Control Alternative Feature 1 ... 3-48
Alternative Feature 17 – Flood Control Alternative Feature 2 ... 3-49

Chapter 4 Affected Environment and Environmental Consequences ... 4-1

Geology, Soils, and Seismicity ... 4-2
Affected Environment ... 4-2
Environmental Consequences and Mitigation Measures ... 4-6
Surface-Water Hydrology and Tidal Hydraulics ... 4-12
Affected Environment ... 4-12
Environmental Consequences and Mitigation Measures ... 4-26
Water Quality ... 4-47
Affected Environment ... 4-47
Environmental Consequences and Mitigation Measures ... 4-61
Public Health ... 4-72
Affected Environment ... 4-72
Environmental Consequences and Mitigation Measures ... 4-75
Biological Resources ... 4-78
Affected Environment ... 4-78
Environmental Consequences and Mitigation Measures ... 4-89

Land Use and Public Utilities 4-131
Affected Environment 4-131
Environmental Consequences and Mitigation Measures 4-148
Hazardous Substances and Waste 4-157
Affected Environment 4-157
Environmental Consequences and Mitigation Measures 4-171
Transportation 4-176
Affected Environment 4-176
Environmental Consequences and Mitigation Measures 4-178
Air Quality 4-181
Affected Environment 4-181
Environmental Consequences and Mitigation Measures 4-185
Noise 4-191
Affected Environment 4-191
Environmental Consequences and Mitigation Measures 4-195
Cultural Resources 4-202
Introduction 4-202
Determination of Significance of Cultural Resources 4-204
Affected Environment 4-206
Environmental Consequences and Mitigation Measures 4-214
Aesthetics 4-218
Affected Environment 4-218
Environmental Consequences and Mitigation Measures 4-220

Chapter 5 Other Required Analyses 5-1

Cumulative Impacts 5-1
Requirements for Analysis 5-1
Approach to Cumulative Impact Analysis 5-1
Geology, Soils, and Seismicity 5-2
Surface-Water Hydrology and Tidal Hydraulics 5-3
Water Quality 5-3
Public Health 5-5
Biological Resources 5-5
Land Use and Public Utilities 5-5
Hazardous Substances and Waste 5-6
Transportation, Air Quality, and Noise 5-7
Cultural Resources 5-8
Aesthetics 5-8
Significant and Unavoidable Impacts 5-8
Irreversible and Irretrievable Commitment of Resources 5-10

Relationship between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity 5-10

Chapter 6 Scoping, Consultation, and Other Requirements 6-1

Scoping 6-1
Consultation and Requirements 6-2
- Federal Endangered Species Act 6-2
- National Historic Preservation Act 6-3
- Farmland Protection Policy Act 6-4
- Fish and Wildlife Coordination Act 6-4
- Marine Protection, Research, and Sanctuaries Act 6-4
- Anadromous Fish Conservation Act 6-5
- Magnuson Fishery Conservation and Management Act 6-5
- Executive Order 11988—Floodplain Management 6-6
- Executive Order 11990—Protection of Wetlands 6-6
- Executive Order 12898—Environmental Justice 6-7

Chapter 7 List of Preparers and Distribution List 7-1

List of Preparers 7-1
- California State Coastal Conservancy 7-1
- U.S. Army Corps of Engineers 7-1
- San Francisco Bay Conservation and Development Commission 7-2
- Jones & Stokes 7-2
- Northwest Hydraulics Consultants 7-3
- Moffitt, Nichol 7-3

Distribution List for Final SEIS/R 7-3
- Federal Agencies Receiving Final SEIR/EIS 7-3
- State Agencies Receiving Final SEIR/EIS 7-4
- Local Agencies Receiving Final SEIR/EIS 7-5
- California Congressional Representatives Receiving Notice of Availability 7-6
- California State Legislature Representatives Receiving Notice of Availability 7-6
- Local Representatives Receiving Notice of Availability 7-7
- Organizations Receiving Notice of Availability 7-7
- Individuals Receiving Notice of Availability 7-10
- Libraries where Final SEIR/EIS is Available 7-10
- Internet Availability 7-10

Chapter 8 References 8-1

References Cited 8-1
Personal Communications 8-16

Chapter 9 Acronyms and Abbreviations 9-1

Appendices

Appendix A Selected Pages from Hamilton Wetland Restoration Project EIS/EIR Project Description

Appendix B Bel Marin Keys Hydrologic and Hydraulic Modeling and Supporting Information

Appendix C Summary of Bel Marin Keys Flood Easements, Marin County Flood Ordinances and Supporting Information

Appendix D Special-Status Plant and Animal Species Table and USFWS and NMFS Correspondence

Appendix E Air Quality Conformity Determination

Appendix F Aesthetics Line of Sight Analysis

Appendix G Scoping Report

Appendix H Draft Section 404 (b) (1) Alternatives Evaluation

Appendix I Agreement Regarding Flooding and Drainage for Bel Marin Keys Unit v Property

Appendix J Land Use Policy Consistency Analysis

Appendix K Draft Monitoring and Adaptive Management Plan

List of Figures

Figure	Follows Page
1-1 Location of the Bel Marin Keys Unit V Expansion Site	1-1
1-2 Bel Marin Keys Unit V Expansion Site	1-1
3-1 Bel Marin Keys Restoration Alternative 1 at Maturity	3-5
3-2 Schematic Cross Sections of Habitats Restored under Alternative 1	3-5
3-3 Construction Approach for Bel Marin Keys Alternative 1	3-13
3-4 Approximate Location of Off-loading Facility	3-16
3-5 Bel Marin Keys Restoration Revised Alternative 2 at Maturity	3-21
3-6 Schematic Cross Sections of Habitats Restored under Revised Alternative 2	3-21
3-7 Construction Approach for Bel Marin Keys Revised Alternative 2	3-25

3-8	Bel Marin Keys Restoration Alternative 3 at Maturity 3-30
3-9	Schematic Cross Sections of Habitats Restored under Alternative 3 3-30
3-10	Construction Approach for Bel Marin Keys Alternative 3 3-34
3-11	Tidal Habitat Evolution for Bel Marin Keys Alternatives 1, 3, and Revised Alternative 2 3-38
3-12	Typical New and Improved Levee Cross Sections Alternatives 1 and 3 3-38
3-13	Typical New and Improved Levee Cross Sections Revised Alternative 2 3-38
4-1	Active and Potentially Active Faults in the Vicinity of the Bel Marin Keys Unit V Expansion Site 4-2
4-2	Hydrologic Setting at the Project Site 4-13
4-3	Flood Zoning Overlays, Flood Related Easements and Drainage Agreements 4-23
4-4	Flood Zoning in the Vicinity of the Bel Marin Keys Unit V Expansion Site 4-23
4-5	Stage Hydrographs at Select Locations along Novato Creek, Scenario A 4-32
4-6	Stage Hydrographs at Select Locations along Novato Creek, Scenario B 4-32
4-7	Novato Creek and Outer Navigation Channel 4-44

4-8 Habitat Types on the Bel Marin Keys Unit V Expansion Site 4-80

4-9 Schematic of Habitats by Tide Levels 4-80

4-10 Common Trail Segments at Hamilton, All Alternatives 4-109

4-11 Current and Adjacent Land Uses at the Bel Marin Keys Unit V Expansion Site 4-144

4-12 Current and Adjacent Zoning at the Bel Marin Keys Unit V Expansion Site 4-144

4-13 Areas of Concern Identified in Prior Phase I and Phase II Studies at BMKV Parcel 4-161

4-14 Areas of Concern Identified at the SLC Parcel 4-162

4-15 Wind Rose Depicting Average Wind Speed and Directional Frequency at Hamilton Army Airfield 4-181

4-16 Key Viewpoints at the Bel Marin Keys Unit V Expansion Site 4-218

4-17 Views of the Bel Marin Keys Unit V Expansion Site from Streets in the Bel Marin Keys Residential Community 4-218

List of Tables

Table .... Page

ES-1 BMKV Expansion Alternatives Considered in this SEIR/EIS ES-4

ES-2 Summary of Impacts and Mitigation Measures .... follows page ES-18

1-1 List of Local, State, and Federal Permits and Other Approvals Expected for the BMKV Expansion of the HWRP .... follows page 1-7

3-1 BMKV Expansion Alternatives Considered in this SEIR/EIS 3-2

3-2 Estimated Postrestoration Habitat Acreages at BMKV Expansion Site 3-4

3-3 Summary of Alternative 1: Dredged Material Placement with Enlarged Pacheco Pond 3-6

3-4 Summary of Revised Alternative 2: Dredged Material Placement with Seasonal Wetland and Enlarged Pacheco Pond 3-21

3-5 Summary of Alternative 3: Natural Sedimentation with Enlarged Pacheco Pond 3-31

3-6 Summary Comparison of Features Associated with the Expansion Alternatives 3-39

3-7 Alternatives Considered but Eliminated from Detailed Analysis 3-41

3-8 Alternative Features Considered but Eliminated from Detailed Analysis 3-41

4-1 Elevations of Levees Adjacent to Bel Marin Keys Unit V Expansion Site 4-14

4-2 Tide Information from the Petaluma River Entrance 4-21

4-3 Peak Water Surface Elevations in Pacheco Pond (feet NGVD 29) 4-31

4-4 Waters in the San Pablo Bay and Tributary to the Bay Listed as Impaired by the San Francisco Bay Regional Water Quality Control Board under Section 303(d) of the Clean Water Act 4-56

4-5 Areas in the San Pablo Bay that Have Significant Sediment Contamination 4-57

4-6 Estimated Acreages of Potential Existing and Post-Restoration Mosquito Breeding Habitat in the Expansion Area 4-73

4-7 Estimated Extent of Habitat Types (Acres) Present in the BMKV Site under the No-Action Alternative and Alternatives 1–3 at Year 50 after Project Implementation, and the Net Change in Extent of Habitat Types Restored Under the Project Alternatives from the No-Action Alternative....... follows page 4-80

4-8 Results of Phase I Environmental Site Assessment and Phase II Shallow Soil Investigation for the BMKV Expansion Site .... follows page 4-161

4-9	Results of Dredged Material Area Soil Testing (2000) (mg/kg, dry weight)	4-162
4-10	Summary of Draft Remedial Investigation Findings for SLC Parcel	4-163
4-11	San Francisco Bay Sediment Screening Criteria and Ambient-Level Thresholds (mg/kg)	4-169
4-12	Results of Novato Creek Sampling (2000)	4-170
4-13	San Pablo Bay/Carquinez Strait Reference Site Sampling	4-171
4-14	Signalized Intersection LOS Criteria	follows page 4-177
4-15	Unsignalized Intersection LOS Criteria	4-177
4-16	Intersection Level of Service and Peak-Hour Freeway Operations	4-177
4-17	Federal and State Ambient Air Quality Standards	follows page 4-181
4-18	Ambient Air Quality Monitoring Data Recorded at San Rafael Monitoring Station	follows page 4-184
4-19	Off-loading Activity NO_X Emissions Summary, BMKV Expansion (annual tons)	follows page 4-190
4-20	Measured Noise Levels at Selected Locations in the BMKV Expansion Area	4-193
4-21	Allowable Noise Exposure from Stationary Noise Sources in Marin County	4-194

4-22 **City of Novato Noise and Land Use Compatibility Standards 4-195**

4-23 **Construction Equipment Noise Emission Levels 4-196**

4-24 **Estimated Onshore Construction Noise in the Vicinity of an Active Construction Site 4-197**

5-1 **Cumulative Habitats, HWRP and BMKV Expansion .... follows page 5-5**

Executive Summary

This summary provides a brief overview of the Bel Marin Keys Unit V (BMKV) Expansion of the Hamilton Wetland Restoration Project (HWRP); project goal and objectives; restoration alternatives; environmental consequences of the proposed project; public issues and areas of controversy; evaluation of the alternatives in terms of the project goals and objectives; and a description of the process for selecting the preferred alternative.

Project Overview

The U.S. Army Corps of Engineers, San Francisco District (Corps) and the California State Coastal Conservancy (Conservancy), in collaboration with the San Francisco Bay Conservation and Development Commission (BCDC), are proposing to restore tidal salt marsh and other wetland habitat at the BMKV property as an expansion of the Hamilton Wetland Restoration Project (HWRP).

The authorized HWRP includes the Hamilton Army Airfield (HAAF) parcel, the Navy Ballfields parcel, and the State Lands Commission (SLC) parcel. For this document, reference to the HAAF parcel includes reference to the Navy Ballfields parcel.

The final environmental report/environmental impact statement (EIR/EIS) for the HWRP was issued in 1998, and the project was authorized in the federal Water Resources Development Act (WRDA) in 1999. The final EIR/EIS for the HWRP contained a programmatic-level analysis of wetland restoration at the BMKV property. At the time of the conceptual design, EIR/EIS, and authorization of the HWRP, the BMKV site was privately owned. The Conservancy purchased the BMKV site in 2001 with the intent of proposing wetland restoration on the site.

This supplemental EIR/EIS (SEIR/EIS) analyzes the environmental impacts of restoring the BMKV site as an expansion of the HWRP.

The purpose of the BMKV Expansion is to restore important tidal wetland habitat in San Francisco Bay. Approximately 90% of the original tidal wetlands of San Francisco Bay have been destroyed. This destruction is the result of the diking and filling of the tidal wetlands for purposes of agriculture, urban development, and salt production. This loss of tidal wetlands has greatly reduced the amount

of habitat available to many species of fish and wildlife. Several local animal and plant species, including the salt marsh harvest mouse and the California clapper rail, have been listed as endangered as a direct result of the reduction in extent and quality of their wetland habitats. Many other species, including migratory birds and numerous fish species also have been affected by this loss of habitat. Restoration of tidal salt marsh habitat at the BMKV property represents the implementation of the local, regional, and national planning efforts listed below.

- The Hamilton Wetland Restoration Project
- The San Francisco Bay Plan
- The Long-Term Management Strategy for Disposal of Dredged Material in San Francisco Bay (LTMS)
- The San Francisco Estuary Project Comprehensive Conservation and Management Plan
- The Ecosystem Restoration Program Plan
- The San Francisco Estuary Baylands Ecosystem Goals Project
- The Marin Countywide Plan
- The City of Novato General Plan
- The Bay Trail Plan
- The Oakland Harbor Navigation Improvement (50-Foot) Project
- The Defense Base Closure and Realignment Act of 1988

These plans are described in chapter 2, *Purpose and Need.*

Separate Remedial Processes

In addition to and separate from the BMKV expansion, there are remedial processes currently underway for areas of identified contamination at the HAAF and SLC parcels. Remedial issues at the HAAF (including Navy Ballfields) parcel are being addressed through the Base Realignment and Closure (BRAC) process. Remedial issues at the SLC parcel are being address through the Formerly Used Defense Site (FUDS) remedial process.

The BMKV expansion makes no determinations regarding potential remedial activities at the HAAF or SLC parcels. The BMKV expansion assumes that the BRAC and FUDS processes will result in implementation of remediation of the parcels to a suitable condition for the proposed wetlands reuse generally in accordance with the present HWRP design. If the remedial determinations ultimately made through BRAC or FUDS require changes in the wetland designs proposed for the HAAF or SLC parcels, the BMKV and HWRP lead agencies

would evaluate the potential effects of the changes and determine whether additional National Environmental Policy Act/California Environmental Quality Act (NEPA/CEQA) compliance would be necessary. Currently, the lead agencies consider it speculative to assume that the BRAC or FUDS process will not result in remedial options that leave the sites in a suitable condition for the proposed wetland reuse.

Goal and Objectives

The project goals and objectives presented in this section are the same as those that were developed for the HWRP. The goals and objectives are the same because the project is being considered as an expansion of the authorized HWRP.

Project Goal

The goal of this project is to create a diverse array of wetland and wildlife habitats at the BMKV and HAAF sites that benefit endangered species as well as other migratory and resident species.

Project Objectives

- To design and engineer a restoration project that stresses simplicity and has little need for active management.
- To demonstrate the beneficial use of dredged material, if feasible.
- To recognize existing opportunities and constraints, including the runway and remediation of contaminated areas of the HWRP, as integral components of design.
- To ensure no net loss of wetland habitat presently provided at the BMKV and HAAF sites.
- To create and maintain wetland habitats that sustain viable wildlife populations, with particular emphasis on supporting Bay Area special-status species.
- To include buffer areas along the upland perimeter of the project area, especially adjacent to residential areas, so wildlife will not be impacted by adjacent land uses.
- To be compatible with adjacent land uses and wildlife habitats.
- To provide for public access that is compatible with protection of resource values and with regional and local public access policies.

Restoration Alternatives

The project objectives could be attained by restoring wetlands, either through the process of natural sedimentation or by actively placing dredged material on the site. The currently authorized HWRP will restore wetlands and other habitats on an approximately 950-acre site to the south and southeast of the BMKV parcel.

Three alternatives to expand the HWRP are evaluated in this SEIR/EIS. The No-Action Alternative is also described in this SEIR/EIS and serves as a baseline condition from which to evaluate the environmental impacts of the 3 restoration alternatives. The 3 restoration alternatives analyzed in this SEIR/EIS are summarized in table ES-1 below. Other alternatives and alternative features considered but not analyzed in this document are described in chapter 3.

Table ES-1. BMKV Expansion Alternatives Considered in this SEIR/EIS

	Alternative 1	Revised Alternative 2 (Preferred Alternative)	Alternative 3
Descriptive Name	Dredged Material Placement with Enlarged Pacheco Pond	Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond	Natural Sedimentation with Enlarged Pacheco Pond
Dredged Material Use	Additional 13.2 million cubic yards above HWRP	Additional 13.8 million cubic yards above HWRP	None at BMKV; 2.6 million cubic yards less than HWRP.
Habitats	1039 acres tidal wetland 147 acres subtidal and tidal mudflat habitats 40 acres seasonal wetland 10 acres emergent wetland 40 acres open water (pond) 300 acres upland	899 acres tidal wetland 120 acres subtidal and tidal mudflat habitats 277 acres seasonal wetland 12 acres emergent wetland 21 acres of open water (pond) 247 acres upland	1,274 acres tidal wetland 197 acres subtidal and tidal mudflat habitats 10 acres emergent wetland 40 acres open water (pond) 55 acres upland
Outboard Levee Breaches	Novato Creek San Pablo Bay (2)	Novato Creek San Pablo Bay	San Pablo Bay (2)
New Levees	From Pacheco Pond to Novato Creek; along east side of expanded Pacheco Pond	From Pacheco Pond along east side of expanded pond; along northeast and southwest sides of seasonal wetland ; along east side of seasonal wetland northeast to Novato Creek	Along east side of Pacheco Pond; from enlarged Pacheco Pond to BMK south lagoon and along BMK south lagoon to Novato Creek.

	Alternative 1	Revised Alternative 2 (Preferred Alternative)	Alternative 3
Improved Levees	BMK south lagoon	BMK south lagoon; portion of BMKV/HAAF berm east of the seasonal wetland; portion of levee west of BMK south lagoon lock	Western portion of BMK south lagoon
Hydrologic Connections	Culverts with flapgates at Pacheco Pond; modified BMK lagoon overflow weirs; culvert with flapgate in Novato Creek levee	Overflow structure from Pacheco Pond to seasonal wetland; overflow structure from seasonal wetland to tidal wetland area; modified BMK lagoon overflow structures into swale; culvert with flapgate from swale into Novato Creek	Culverts with flapgates at Pacheco Pond; pump station near BMK south lagoon lock
Proposed Bay Trail Routes, Spur Trail Options, and Interpretive Center/Access Area Location	South and north from City levee and along west side of Pacheco Pond to BMK Blvd. Option 1A along central levee to Novato Creek. Interpretive center/access area on property currently owned by the City of Novato west of the HWRP.	South and north from City levee, around east side of expanded Pacheco Pond to BMK Blvd around west side of Headquarters Hill. Interpretive center/access area on property currently owned by the City of Novato west of the HWRP.	South and north from City levee, around east side of expanded Pacheco Pond to BMK Blvd. Option 3A along new levee just south of BMK south lagoon levee to Novato Creek. Interpretive center/access area on northwest part of BMKV.
Novato Sanitary District Outfall	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Alt. 1 includes extension of new pipeline around east side of Pacheco Pond, and access road/berm.	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Revised Alt. 2 includes extension of new pipeline around east side of expanded pond and access road/berm.	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Alt. 3 includes extension of new pipeline around east side of Pacheco Pond, and access road/berm.

The 3 alternatives include the addition of the BMKV expansion area itself, as well as the following potential changes to the authorized HWRP.

- Elimination of a separating levee between the BMKV and SLC sites
- Replacement of the barrier levee between BMKV and HAAF with an access berm for the NSD line
- Extension of the Bay Trail southward and northward from the City of Novato levee
- Potential use of diesel unloading and booster pumps for offloading dredged material

- Potential alternative alignment of pipeline directly from the offloading facility to the BMKV site (Alternatives 1 and 2)
- Change in location of and increase in high transitional marsh acreage on the SLC parcel
- Relocation of the tidal breach on SLC to BMKV (Alternatives 2 and 3)
- Addition of new NSD pipeline around east side of expanded Pacheco Pond

Environmental Consequences

This SEIR/EIS evaluates the environmental consequences of the restoration alternatives. A summary of the impact analysis for these alternatives is presented at the end of this chapter (table ES-2). In addition, CEQA and NEPA require a review of other issues summarized below.

Significant Unavoidable Effects

For the proposed BMKV expansion, this Draft SEIR/EIS identifies several potentially significant impacts that may not be mitigated to a less-than-significant level.

There is a potential for an increase of methylmercury production due to the increase of tidal wetland acreage in contact with sediments containing mercury. These sediments include those that might be dredged sediments placed on the site (Alternative 1 and Revised Alternative 2) and natural sedimentation from Novato Creek or San Pablo Bay (all alternatives). While the project would only accept dredged material that meets cover criteria (Alternative 1 and Revised 2), methylmercury production in tidal wetlands is poorly understood at present, and the cover criteria are for total mercury, not methylmercury. An adaptive management strategy concerning this impact is proposed in the *Water Quality* section of the document. However, because scientific understanding of this impact is insufficient to provide a definitive conclusion regarding the significance of the impact and the potential efficacy of mitigation, this impact is currently assumed to be significant and unavoidable.

The offshore unloading facility and booster pump platforms for unloading of dredged material could be built on piles that need to be pile-driven. Pile-driving equipment can produce localized noise that can affect listed fish species and marine mammals in areas immediately adjacent to the pile-driving activities. While population-level impacts are not expected, construction may result in mortality of individual fish and harassment of individual marine mammals present in the immediate vicinity of pile-driving activity. This impact is considered a potentially significant, though temporary, effect. Mitigation is proposed. Even with mitigation, however, there is the potential for individual

mortality of listed fish species and harassment of marine mammals immediately adjacent to pile-driving activity, and this impact is considered significant and unavoidable, if pile-driving is used. It should be noted that the project would result in an increase in tidal marsh habitat, including subtidal channels that would provide rearing habitat for both listed and common fish species that currently use San Pablo Bay.

As described in the *Visual Aesthetics* section of chapter 4, with the changes in levee location and height included in Revised Alternative 2, the visual impacts of the new levees constructed under that alternative are considered less than significant. Alternatives 1 and 3 would include construction of a new levee much closer to the BMK south lagoon and with a higher initial construction height than the levee that would be constructed under Revised Alternative 2. Unless the changes in levee elevations and locations from Revised Alternative 2 were incorporated into Alternatives 1 and 3, these alternatives would have a significant and unavoidable visual impact.

Irreversible and Irretrievable Commitment of Resources

The proposed BMKV expansion would result in the irretrievable commitment of fossil fuels and other energy sources needed to build, operate, and maintain the wetlands. The proposed wetland restoration, however, is not considered an irreversible commitment because the landscape could be converted for other land uses in the future. The BMKV expansion does not involve converting the land for urban land uses, which tends to be irreversible.

Relationship between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term uses of the environment that would occur with restoration include the impacts on existing wetlands and habitat. As discussed in chapter 4, construction would result in the loss of wetland and upland habitat that presently exists at the BMKV expansion site. However, in the long term, the site is expected to be substantially more productive for fish and wildlife and associated habitat values, through the restoration of tidal wetlands and other habitats on-site.

The timeframes for construction of the different alternatives vary, as well as the expected timeframe to the establishment of wetland habitats on the site. Alternative 1 and Revised Alternative 2 both involve the placement of substantial amounts of dredged material and the overall construction period associated with these alternatives could last up to 13 years. However, a phased approach will be

used, which will allow completion of restoration activities on individual tidal cells in advance of completion of restoration activities on the entire site, and the first tidal cell may be ready for opening to tidal action approximately 7 to 8 years after commencement of construction. Under Alternative 1 and Revised Alternative 2, low marsh would begin to establish first, with mid/high marsh beginning to establish approximately 10 years after opening the site to tidal action. Thus, from commencement of construction activities, which would affect existing habitats, mid/high marsh could begin to establish on the first cell approximately 17 to 18 years after commencement of construction, with mid/high marsh beginning to establish on the remainder of the site approximately 27 to 28 years after commencement of construction.

Under Alternative 3, the overall construction period (5 years) is shorter than the other two alternatives, but due to a reliance primarily on natural sedimentation, wetland establishment will occur much more slowly with mudflats taking 5 years to establish; low marsh – 15 years; and mid-marsh – approximately 40 years. From the commencement of construction, it could take approximately 45 years to establish mid/high marsh. Thus, under Alternative 3, there would be a longer gap between the loss of existing habitat and the establishment of restoration habitat.

Public Issues, Public Involvement, and Areas of Controversy

Through a series of workshops in fall 2001 and a formal scoping meeting in December 2001, the lead agencies conferred with representatives from the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (DFG), Marin County Flood Control and Water Conservation District (MCFCWCD), Novato Sanitary District (NSD), City of Novato, County of Marin, Bel Marin Keys Community Services District (BMK CSD), and local residents.

Key issues of public concern reagarding the proposed BMKV expansion that were identified during the workshops and the scoping process include the following.

- Flood protection
- Drainage easements and agreements
- Public access/Bay Trail alignments
- Novato Creek sedimentation/dredging/navigation
- Effects on Pacheco Pond
- Levee protection and stability
- Existing wildlife habitats

- Buffers between residential and restoration area
- Compatibility of habitat and access components
- Novato Sanitary District outfall alignment
- Use/quality/handling of dredged material
- Hazardous waste

Appendix D describes the public involvement and scoping process and results in greater detail. All of the above-identified key public issues were discussed in the analysis of project effects included in the Draft SEIR/EIS document.

The Draft SEIR/EIS was released for agency and public review and comment on July 19, 2002. The comment period on the draft document was from July 19, 2002 to September 13, 2002. A public hearing to receive oral comment was held on August 21, 2002, in Novato, California. Written responses to all oral comments provided at the public hearing and all written comments received during the comment period that raised substantive issues were prepared. The comments and responses to the comments are provided in a separate volume. Key additional issues of public concern relevant to the Draft SEIR/EIS (beyond those noted above in scoping) that were raised during the public comment period include the following.

- Navigation in Novato Creek
- Flood insurance
- Scenic views from adjacent residences
- Traffic along Bel Marin Keys Boulevard
- Public health (particularly mosquito breeding habitat)

With the exception of flood insurance, all of these key issues were discussed in the Draft SEIR/EIS. Discussion of flood insurance has been added to the Final SEIR/EIS.

As noted in the responses to comments, several changes were made in the preferred alternative to avoid or reduce certain environmental effects or to further the project's goal and objectives (see discussion below). In addition, revisions have been made to the Draft SEIR/EIS to describe the changes in the preferred alternative, address concerns raised by comment, and make clarifications or add information requested by comment that is relevant to the assessment of environmental effects. None of the changes made to the Draft SEIR/EIS have resulted in new significant effects of the project that cannot be mitigated to a less-than-significant level or that significantly increase the severity of previously identified significant impacts.

Of the public issues raised to date, several may be identified as controversial by certain parties and are are described below.

- Flooding – As noted above, hydrologic and hydraulic studies conducted to support this SEIR/EIS identify that the preferred alternative would actually reduce peak stage in Pacheco Pond and would not result in increased flooding. Although some local residents questioned this conclusion in the Draft SEIR/EIS, no substantial evidence was raised in comment to warrant a change in this conclusion. Regarding flood insurance, because of the conclusion regarding flooding, no project-related change in offsite flood hazard zone mapping or flood insurance rates are expected.

- Flood zoning – The Corps and Conservancy have been conferring with MCFCWCD and other parties concerning the consistency of the proposed wetland restoration with the Marin County F-1 and F-2 zoning overlay designations of the BMKV site. Hydrologic and hydraulic analysis conducted for this document identified that the proposed wetland restoration would not have a physical adverse effect on flooding in neighboring areas. The MCFCWCD has not yet formally determined whether the project is or is not consistent with the requirements of the flood zoning ordinances. Pursuant to an Agreement with the Conservancy, MCFCWCD has requested an additional hydrologic and hydraulic study, which is being conducted. As of this SEIR/EIS, the Corps and Conservancy have determined that, even if the project were determined later to be inconsistent with the flood zoning requirement, this would not be a significant effect on the environment, as defined by CEQA and NEPA, because the project is not expected to result in an increase in flood risk to people or property. The Agreement established a process by which the Conservancy, the City of Novato, and MCFCWCD can resolve the zoning issues prior to construction. The Corps and Conservancy expect that the additional studies will confirm the studies conducted to support this SEIR/EIS, and that the flood zoning issues will be resolved to the satisfaction of all parties prior to construction

- Drainage easements and agreements – Some of the existing MCFCWCD drainage agreements will need to be amended to allow the project to go forward. The Conservancy is working with MCFCWCD to resolve the nature of the required amendments as part of the Agreement. The drainage easement with the BMK CSD for lagoon overflow from the south lagoon is accommodated by the preferred alternative.

- Novato Creek Navigation – The results of hydraulic assessment conducted for the SEIR/EIS have not identified a significant adverse effect of the preferred alternative on Novato Creek morphology or navigation. The SEIR/EIS concludes that the preferred alternative would result in an incidental navigation benefit to the lower Novato Creek channel due to the addition of tidal prism below the proposed levee breach.

- Bay Trail routing – The different alternatives presented in this document for the Bay Trail and potential trail options frame a range of possible routes. Agency and public opinion on the tradeoffs of public access, wildlife protection, and proximity to private residences often diverge. However, the SEIR/EIS provides a reasonable range of alternatives and options for consideration by the lead agencies when making decisions regarding the

selection of the preferred alternative. Further, changes have been made in the preferred alternative in response to a number of the access concerns raised in comment.

Selection of the Preferred Alternative

As noted in the Draft SEIR/EIS, the Corps had tentatively recommended Alternative 2 as the preferred alternative. After a review of the Draft SEIR/EIS analysis; the comments received from agencies, the public, and interested organizations; the response to comments presented in this document; the revised analysis in the Final SEIR/EIS; and a review of the project goals and objectives; the Corps and Conservancy decided to incorporate certain changes in Alternative 2 to address concerns raised in comment and to further the project goal and objectives. These revisions are described in greater detail in chapter 3. With these revisions to Alternative 2, the Corps and Conservancy determined that this alternative best meets the project goal and objectives, is responsive to a number of concerns raised by the local community, has incorporated feasible mitigation where significant effects have been identified. Alternative 2 is therefore selected as the preferred alternative. In addition, Alternative 2 is also considered the environmentally superior alternative based on the environmental analysis contained in the SEIR/EIS and on an evaluation of the estimated habitat benefits.

The Corps objective in ecosystem restoration planning is to contribute to national ecosystem restoration through increases in the net quantity and/or quality of desired ecosystem resources. Each alternative plan is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency and acceptability. In addition, four accounts are established to facilitate evaluation and display the effects of alternative plans. For single-purpose ecosystem restoration projects such as the Bel Marin Keys Unit V Expansion of Hamilton Wetlands Restoration Project, these four accounts are National Ecosystem Restoration (NER), Environmental Quality (EQ), Regional Economic Development (RED) and Other Social Effects (OSE). The NER plan is identified by the Federal government as the plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective. It is cost-effective and justified to achieve the desired level of outputs. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity. These net changes are measured in the planning area and in the rest of the Nation. The EQ account displays non-monetary effects on significant natural and cultural resources. The RED account registers changes in the distribution of regional economic activity that result from each alternative plan. The OSE account registers plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts. The rationale for the Corps' recommendation is explained in greater detail in the Final General Reevaluation Report (GRR), in a separately bound volume, which is available at the repository libraries and locations noted in Chapter 7.

The following section provides a comparative discussion of the degree to which the different restoration alternatives meet the project goal and objectives.

Diverse Array of Habitats

Goal: *The goal of the proposed BMKV expansion is to create a diverse array of wetland and wildlife habitats at the BMKV and HAAF sites that benefit endangered species as well as other migratory and resident species.*

All 3 alternatives would provide an array of habitats that would benefit sensitive tidal-wetland-dependent species, migratory birds, and other species. Revised Alternative 2 would provide the greatest diversity of habitats by type because it includes tidal wetlands (899 acres), seasonal wetlands (277 acres), emergent wetlands (12 acres), open water habitat (21 acres) and upland habitat (247 acres), and because it provides more non-tidal wetlands than the other alternatives. Alternative 1 would provide more tidal wetlands (1,039 acres) and upland habitat (300 acres), and a slightly larger pond expansion (40 acres) than Revised Alternative 2, but far less seasonal wetlands (40 acres). Alternative 3 would provide the greatest amount of tidal wetland habitat (1,274 acres), but far less upland (55 acres) and seasonal wetlands (10 acres) than Revised Alternative 2. While Alternative 3 would provide the greatest amount of overall restored wetland habitat (1,284 acres), it would be the least diverse because of the dominance of tidal wetland. The timeframe for establishing elevations suitable for mid-to high-tidal marsh establishment under Alternative 3 is approximately 30 years slower than under Alternatives 1 and 2, which employ dredged material placement.

Management Considerations

Objective: *To design and engineer a restoration project that stresses simplicity and has little need for active management.*

All 3 alternatives require maintenance of new and existing levees. It is presumed that the BMK CSD would continue to maintain the BMK south lagoon levee. All 3 alternatives would require periodic maintenance of the various water management structures. Alternative 1 and Revised Alternative 2 would also require periodic maintenance of the overflow structures from the BMK south lagoon levee. Alternative 3 would require maintenance and periodic operation of a relief pump. The Bay Trail, trail spurs (if built), and interpretive center/access area would also require periodic maintenance.

Alternative 1 and Revised Alternative 2 are considered roughly equivalent in the amount of maintenance they are likely to require. Alternative 3 is considered to require a greater amount of active management because of the use of mechanical pumping for overflow relief from the BMK south lagoon.

Beneficial Use of Dredged Material

Objective: *To demonstrate the beneficial use of dredged material, if feasible.*

Alternative 1 and Revised 2 use approximately the same amount of additional dredged material (13 - 14 million cubic yards) and are considered equivalent in meeting this objective. Restoration of wetlands under Alternative 3 is based on the process of natural sedimentation in the BMKV site. Alternative 3 would not require the use of dredged material on the BMKV site, would result in less dredged material being placed on the SLC parcel than currently envisioned in the HWRP, and thus does not meet this objective. Under any alternative, dredged material would continue to be used at the HAAF parcel, as authorized in the HWRP.

Site Opportunities and Constraints

Objective: *To recognize existing opportunities and constraints, including the runway and remediation of contaminated areas of the HWRP, as integral components of design.*

Site opportunities and constraints were considered in the site design for all alternatives.

Key opportunities at the BMKV site include the following.

- *Use of dredged material to accelerate wetland formation* – Implementation of the LTMS calls for the beneficial reuse of dredged material, and Alternatives 1 and 2 would facilitate this reuse on the BMKV site. Alternative 3 would not.
- *Hydrological linkage of restored wetlands to adjacent water bodies* – All alternatives would reestablish a hydrological link between Pacheco Pond and wetlands on the BMKV site. All alternatives include establishment of a tidal connection to San Pablo Bay. Alternative 1 and Revised Alternative 2 of the alternatives include establishing a hydrological link to Novato Creek. Alternative 1 and Revised Alternative 2 are considered to incorporate this opportunity better than Alternative 3.
- *Integration of the Expansion Area into the HWRP* – The authorized HWRP includes a perimeter levee on the north side of the HWRP to separate it from the BMKV site. Expanding the HWRP to include the BMKV site would eliminate the need for a separating levee between the SLC parcel and BMKV site. A reconstructed berm would be necessary between the BMKV site and HAAF parcel to allow for maintenance and emergency access for the NSD outfall pipeline, but it would not need to be constructed as a flood control levee. This would engender a cost savings for the HWRP. All alternatives

would allow for the elimination of the separating levee between the SLC parcel and the BMKV site.

- *Extension of the Bay Trail* – The alternatives include several different routings that would facilitate the extension of the Bay Trail from the authorized HWRP to Bel Marin Keys Boulevard. Therefore, all of the alternatives incorporate this opportunity.

Key constraints at the BMKV site include the following.

- *Flood Easements and Zoning* – As noted above, the BMKV site has several recorded flood easements and is zoned as a flood overflow area. All of the alternatives would enhance flood storage of Pacheco Pond. The hydrology and hydraulic analysis conducted as part of the preparation of this document did not identify adverse physical effects of the restoration alternatives on flooding related to adjacent properties. While none of the alternatives would result in increased flooding, Revised Alternative 2 provides for a greater amount of ponding capacity connected to Pacheco Pond and to the BMK south lagoon than either Alternative 1 or 3. While the zoning and easements are still being resolved in coordination with MCFCWCD, because of the greater retained ponding capacity in Revised Alternative 2, this alternative may be more favorably reviewed during resolution of the zoning and easement requirements.
- *Availability of Dredged Material* – The recent increase in wetland projects dependent upon the use of dredged material for wetland restoration means that there may be a lack of available dredged material in the future. Although this is not currently considered a constraint on development of the HWRP or the BMKV expansion, Alternative 1 and Revised Alternative 2 employ a phasing concept wherein portions of the site can be restored in phases, which allows for the use of varying amounts of available dredged material.
- *NSD* – NSD has an existing outfall on the BMKV site. All of the alternatives include either retrofitting the existing outfall or placing a replacement outfall pipeline, mostly along the existing alignment to accommodate this use.
- *SLC Parcel* – Studies have identified soil contamination at several locations on the SLC parcel, which is part of the authorized HWRP. The SLC parcel will be remediated to a level suitable for wetland reuse through the separate FUDS process. Integration of wetland restoration at the BMKV site with the authorized project on the SLC parcel could result in tidal channel formation across areas that currently contain contaminated soil. While remediation of these sites is not part of the BMKV expansion, all of the alternatives would include the additional placement of dredged material on the southeast corner of the SLC parcel to reduce the potential for channel formation across areas where the selected remedial option may include leaving contaminated soil in place.

No Net Loss of Wetland Habitat at the BMKV and HAAF Sites

Objective: *To ensure no net loss of the wetland habitat presently at the BMKV and HAAF sites.*

All 3 alternatives would result in the restoration of tidal wetlands and associated habitat functions, but would also result in the temporary loss of seasonal wetlands and a decrease in agricultural wetlands.

Under Alternative 1, it is presumed that the replacement of existing wetland habitat value will be through the in-kind value of new freshwater emergent wetlands (10 acres), seasonal wetlands (40 acres), and the out-of-kind value of the tidal marsh (1,039 acres). Under Alternative 3, it is presumed that the replacement of existing habitat value would be through the in-kind value of new freshwater emergent wetlands (10 acres), seasonal wetland (10 acres), and the out-of-kind value of the tidal marsh (1,274 acres).

Under Revised Alternative 2, the replacement of existing wetland habitat value relies much more on in-kind value than under the other two alternatives. It is presumed that the replacement of existing habitat value will be through the in-kind value of seasonal wetlands (277 acres) and emergent marsh habitat (12 acres), as well as through the out-of-kind value of tidal marsh (899 acres). A greater reliance on in-kind replacement of existing wetland habitat indicates that Revised Alternative 2 better meets the no-net loss objective.

Final conclusions about the habitat values of the restored areas of the BMKV expansion compared to the existing habitats will be made when the Coordination Act Report (CAR) is completed with the supporting Habitat Evaluation Procedure (HEP) study. The CAR is being prepared by USFWS in cooperation with the Corps and in compliance with the Fish and Wildlife Coordination Act. The act requires federal agencies to coordinate with USFWS regarding impacts of any federal project on fish and wildlife. HEP is a method of quantifying an index value to compare the relative values of existing and future habitats.

Creation and Maintenance of Wetland Habitats that Support Bay Area Special-Status Species

Objective: *To create and maintain wetland habitats that sustain viable wildlife populations, with particular emphasis on supporting Bay Area special-status species.*

Habitat types created under all alternatives include subtidal channel, tidal mudflat, low marsh, tidal marsh, high transitional marsh, seasonal wetland, emergent marsh, open water, and upland. As described above, it is estimated that

80 to 90 percent of the tidal wetlands in San Francisco Bay have been lost, and tidal wetlands support several special-status species, including the listed California clapper rail and the salt marsh harvest mouse. Alternative 1 would create approximately 1,039 acres of tidal wetland compared to 899 acres under Revised Alternative 2. Alternative 3 would create a larger amount of tidal wetland (1,274 acres), but would take approximately 30 years longer than the other two alternatives to establish. Several special-status species also use seasonal wetland. Alternative 1 would include 40 acres of seasonal wetland, Revised Alternative 2 would include 277 acres of seasonal wetland, and Alternative 3 would include 10 acres of seasonal wetland.

Alternative 3 best meets the objective in terms of creating new tidal habitat to support listed species, and Revised Alternative 2 best meets the objective in terms of creating seasonal wetlands to support other sensitive species. Alternative 1 also meets this objective, though with a different habitat mix. Overall, all 3 alternatives are considered to meet this objective, though with different mixes of habitats.

There would be no routine maintenance required for any created tidal habitats after breaching. Maintenance of water structures would be required in order to ensure that the new seasonal wetland habitats receive water and the site drainage performs as designed. As noted above, Alternative 3 would require maintenance of the pumping station, although this would be performed for flood relief, not for habitat maintenance.

Buffers between Wildlife and Adjacent Land Uses

Objective: *To include buffer areas along the upland perimeter of the project area, especially adjacent to residential areas, so wildlife will not be impacted by adjacent land uses.*

Alternative 1 and Revised Alternative 2 provide upland buffers between the restored wetlands and the BMK residential area, in addition to the BMK south lagoon itself. However, Revised Alternative 2 includes a larger swale area with a greater separation between the tidal restoration area (which would be the most sensitive habitat on the future site because of its likely use by listed species) and the BMK residential area, and meets this objective better than Alternative 1.

Under Alternative 3, the only buffers between the restored tidal wetland area would be the south lagoon levee and the new levee constructed immediately south of the south lagoon levee, and this alternative therefore only partially meets the buffer objective.

Compatibility with Adjacent Land Uses and Wildlife Habitats

Objective: *To be compatible with adjacent land uses and wildlife habitats.*

Land uses adjacent to the wetland restoration site include residential development, open space (Pacheco Pond), and Novato Creek and San Pablo Bay.

Alternatives 1 and 3 both include new levees that were determined in the Draft SEIR/EIS to have a significant effect on existing residential views of the site. Revised Alternative 2 includes new levees that would be located further from the adjacent residential views and would have lower construction heights; these levees would have less-than significant aesthetic impacts.

Alternatives 1 and 3 both include a spur trail along the new levees to Novato Creek. Numerous residents in the BMK residential community objected to the potential for a spur trail. No spur trail is included in Revised Alternative 2. Alternative 3 includes an interpretive center/access area adjacent to the western part of the BMK residential area; this location was also opposed in numerous resident comments. In the preferred alternative, the center/access area was moved to the property currently owned by the City of Novato adjacent to HAAF.

Wildlife habitats adjacent to the BMKV site include the outboard tidal marsh and tidal flat areas in San Pablo Bay and Novato Creek, the restoration area at the HAAF and SLC parcels, and the brackish open water and wetland habitats in Pacheco Pond. The restoration alternatives would enhance the value of the adjacent tidal habitat areas by adding substantial acreage of tidal habitat. The hydrologic connections to Pacheco Pond will be designed in conjunction with development of a water management plan to maintain the flood control and wildlife habitat purposes of the pond.

Regarding wildlife habitat, all alternatives are considered compatible with adjacent habitats. Regarding adjacent land uses, Revised Alternative 2 is more compatible with adjacent residential uses in Bel Marin Keys than Alternatives 1 and 3.

Public Access Compatible with Protection of Resource Values

Objective: *To provide for public access that is compatible with the protection of resource values and with regional and local public access policies.*

Public access to the expansion site would be provided under all 3 alternatives. All alternatives include consideration of resource protection in development of the final design of trails, as well as a trail management plan. Specific mitigation

approaches are included in this SEIR/EIS to reduce impacts of Bay Trail access on wildlife under each alternative.

The design and management of the Bay Trail route under Alternative 1 west of Pacheco Pond would require more detailed mitigation for the protection of resource values because of the trail's proximity to the riparian area at the confluence of Arroyo San Jose and Pacheco Creek and directly adjacent to Pacheco Pond. A trail around the west side of Pacheco Pond is also not consistent with the preferred alignments in City of Novato and Marin County general plans.

The design and management of the spur trails included in Options 1A and 3A would require more detailed and rigorous mitigation for the protection of resource values because of the trail's proximity to the tidal marsh restoration area and Novato Creek. While the spur trails are not specifically included in local planning, neither are they excluded. Greater management of the spur trails included in Alternatives 1 and 3 would likely be necessary because the trails would provide public access to Novato Creek and they would be in close proximity to habitat supporting listed species.

Revised Alternative 2 is consistent with local planning and avoids the impacts of opening public access to Novato Creek (as under Alternatives 1 and 3) and to areas adjacent to tidal restoration areas (as under Alternatives 1 and 3), or of opening public access through the riparian confluence area and immediately adjacent to Pacheco Pond (as under Alternative 1). Therefore, Revised Alternative 2 is considered to best meet this objective.

Table ES-2. Summary of Impacts and Mitigation Measures

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Geology, Soils, and Seismicity			
No-Action Alternative			
Impact G-1: Continued Land-Surface Settlement, Substantial Alteration of Natural Topography, and Loss of Soil Resources Capable of Supporting Sensitive Wetland Habitats	No Impact		
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact G-2: Settlement of Proposed Levees, Uplands, Seasonal Wetlands, and Tidal Wetlands in Response to the Placement of Static Fill Loads	Less than Significant		
Impact G-3: Potential Levee Slope Failure Resulting from the Low Shear Strength of Underlying Bay-Mud Deposits	Less than Significant		
Impact G-4: Potential Short-Term Increase in Erosion and Sedimentation Rates During Project Construction	Less than Significant		
Impact G-5: Potential Damage to Proposed Levees Resulting from Earthquake-Induced Ground Shaking and Lurch Cracking	Less than Significant		
Impact G-6: Potential Exposure of Levees and Sensitive Wetlands to Tsunamis or Seiches	Less than Significant		
Surface Water Hydrology and Tidal Hydraulics			
No-Action Alternative			
No impacts.			
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact HYD-1: Potential for Change in Peak Stage in Pacheco Pond	Beneficial		
Impact HYD-2: Potential Change in Pacheco Pond Peak Stage	Beneficial		

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact HYD-3: Potential Increases in Pacheco Pond Overflows into the Leveroni Property	Beneficial		
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact HYD-4: Potential Increases in Novato Creek Flood Stage	Beneficial		
Impact HYD-5: Potential Change in Drainage Capacity from the Bel Marin Keys Lagoons	Beneficial		
Impact HYD-6: Potential Increases in Tidal Flooding	Less than Significant		
Impact HYD-7: Potential Inconsistency with Flood Zoning	Less than Significant		
Impact HYD-8: Potential Conflict with Existing Drainage Agreements	Less than Significant		
Impact HYD-9: Potential Changes in Flood Zone Mapping and Flood Insurance	Less than Significant		
Impact TH-1: Modification to Circulation in San Pablo Bay	Less than Significant		
Impact TH-2: Changes in Circulation and Morphologic Evolution in Existing Tidal Wetlands	Significant	Mitigation Measure BIO-7: Monitor Site Development and Implement Actions to Increase the Rate of Marsh Development, if Required	Less than Significant
Impact TH-3: Potential Changes in Lower Novato Creek Morphology due to Relocation of Pacheco Pond Outlet	Less than Significant		
Impact TH-4: Potential Changes in Pacheco Pond Outlet Channel due to Diversion of Outlet Flow	Less than Significant		
Impact TH-5: Outboard Marsh Shoreline Erosion	Less than Significant		
Impact TH-6: Excessive or Unexpected Erosion of Perimeter Levees	Less than Significant		
Impacts and Mitigation Measures Common to Alternative 1 and Revised Alternative 2			
Impact TH-7: Modification to Sedimentation Processes and Morphology in San Pablo Bay	Less than Significant		

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact TH-8: Modifications to Sedimentation Processes and Morphology of Novato Creek due to Breach of BMKV/Novato Creek Levee	Less than Significant		
Impact TH-9: Potential Increase in Existing Levee Erosion on Novato Creek	Less than Significant		
Impact TH-10: Modification to Circulation in Novato Creek	Less than Significant		
Impacts and Mitigation Measures Unique to Alternative 3			
Impact TH-11: Modification to Sedimentation Processes in San Pablo Bay	Significant	Mitigation Measure TH-1: Perform an Assessment of Modifications to Sedimentation Processes in San Pablo Bay for Alternative 3 and Implement Phased Tidal Cell Development, if Necessary	Less than Significant
Water Quality			
No-Action Alternative			
No Impact			
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact WQ-1: Potential for Degradation of Surface Water and Sediment Quality due to Increased Methylmercury Formation Potential	Potentially Significant and Unavoidable	Mitigation Measures WQ-1: Implement Methylmercury Adaptive Management Plan	Potentially Significant
Impact WQ-2: Potential Degradation of Groundwater Quality	Less than Significant		
Impact WQ-3: Potential for Degradation of Water Quality in Restored Wetlands from NSD discharges	Less than Significant		
Impact WQ-4: Beneficial Increases in Dissolved Oxygen Concentration in Receiving Waters	Beneficial		
Impact WQ-5: Potential Exceedance of Water Quality Objectives due to Inadequate Flushing in Restored Wetlands	Less than Significant		
Impact WQ-6: Potential Diesel Pump Spills into San Pablo Bay	Significant	Mitigation Measure WQ-2: Provide for Spill Protection at Offloader and at Booster Pump Facility	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact WQ-7: Potential for Changes in Salinity Levels within Novato Creek	Less than Significant		
Impact WQ-8: Potential Changes to Circulation in Pacheco Pond	Significant	Mitigation Measure WQ-3: Incorporate Pacheco Pond Water Quality Concerns Regarding Circulation in New Water Management Plan, in Cooperation with MCFCWCD and CDFG.	Less than Significant
Impacts and Mitigation Measures Common to Alternative 1 and Revised 2			
Impact WQ-9: Potential for Degradation of Receiving Water Quality due to Dredged Material Placement	Significant	Mitigation Measure WQ-4: Develop and Implement Water Quality Monitoring Program for Dredged Material Placement.	Less than Significant
Impacts Unique to Alternative 3			
Impact WQ-10: Potential for Spills from Fueling of Pump(s) at Pump Station	Significant	Mitigation Measure WQ-5: Provide for Spill Protection at Pump Station.	Less than Significant
Public Health			
No Action Alternative			
No impact			
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact PH-1. Increase of Potential Mosquito Breeding Habitat	Significant	Mitigation Measure PH-1: Coordinate Restoration Design and Expansion Activities with MSMAD	Less than Significant
Biological Resources			
No-Action Alternative			
No Impact			

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact BIO-1: Increase in Subtidal Aquatic Habitat for Resident and Anadromous Fish	Beneficial		
Impact BIO-2: Short-Term Loss of or Disturbance to and Long-Term Increase in Intertidal Mudflats	Less than Significant		
Impact BIO-3: Temporary Disturbance to the Northern Harrier, White-Tailed Kite, Golden Eagle, Cooper's Hawk, Sharp-shinned Hawk, Short-Eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow During Construction	Significant	Mitigation Measure BIO-1: Conduct Surveys to Locate Northern Harrier, White-Tailed Kite, Golden Eagle, Cooper's Hawk, Sharp-shinned Hawk, Short-Eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow Nest Sites Before Construction Is Initiated and Avoid Breeding Sites	Less than Significant
Impact BIO-4: Potential for Construction-Related Mortality of Salt Marsh Harvest Mice	Significant	Mitigation Measure BIO-2: Remove Salt Marsh Harvest Mouse Habitat and Place Barrier Fencing in the Immediate Vicinity of Operating Equipment.	Less than Significant
Impact BIO-5: Potential for Construction-Related Mortality of California Clapper Rails and California Black Rails	Significant	Mitigation Measure BIO-3: Avoid Operation of Equipment within 250 feet of the Outboard Tidal Coastal Marsh During the Breeding Period of the California Clapper Rail and California Black Rail	Less than Significant
Impact BIO-6: Potential for Mortality of San Pablo Song Sparrows	Significant	Mitigation Measure BIO-4: Conduct Surveys to Locate San Pablo Song Sparrow Nest Sites before Construction Is Initiated and Avoid Breeding Sites	Less than Significant
Impact BIO-7: Potential for Mortality of Burrowing Owls	Significant	Mitigation Measure BIO-5: Conduct Surveys to Locate Burrowing Owl Nest Sites before Construction Is Initiated and Avoid Breeding Sites	Less than Significant
Impact BIO-8: Potential for Construction-Related Mortality of Outmigrating Salmonid Smolts	Significant	Mitigation Measure BIO-6: Avoid Construction that Could Affect Tidal Aquatic Habitats when Salmonid Smolts Could Be Present	Less than Significant

Table ES-2. Continued

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact BIO-9: Potential for Reduced Access to Freshwater Habitat for Anadromous Salmonids	Less than Significant		
Impact BIO-10: Potential Disturbance to or Mortality of Special-Status Species Resulting from Monitoring and Adaptive Management Activities	Significant	Mitigation Measure BIO-7: Develop and Implement a Restoration Monitoring and Adaptive Management Program Designed to Minimize Potential Impacts on Special-Status Species.	Less than Significant
Impact BIO-11: Loss of Refugia for the California Clapper Rail, California Black Rail, and Salt Marsh Harvest Mouse	Less than Significant		
Impact BIO-12: Increase in Suitable Habitat for the Brown Pelican and Double-Crested Cormorant	Beneficial		
Impact BIO-13: Increase in Suitable Nesting Habitat for Resident Waterfowl	Beneficial		
Impact BIO-14: Loss of Coastal Salt Marsh	Significant	Mitigation Measure BIO-8: Monitor Site Development and Implement Actions to Increase the Rate of Marsh Development, If Required	Less than Significant
Impact BIO-15: Loss of Brackish Open Water Habitat and Brackish Marsh	Significant	Mitigation Measure BIO-9: Monitor Development of Brackish Open Water, Emergent Marsh, and/or Seasonal Wetlands.	Less than Significant
Impact BIO-16: Loss of Seasonal Wetlands	Less than Significant		
Impact BIO-17: Loss of Agricultural Wetlands	Less than Significant		
Impact BIO-18: Loss of Grassland at BMKV Site	Less than Significant		
Impact BIO-19: Loss of Habitat for California Clapper Rail, California Black Rail, Salt Marsh Harvest Mouse, and Saltmarsh Common Yellowthroat	Significant	Mitigation Measure BIO-8: Monitor Site Development and Implement Actions to Increase the Rate of Marsh Development, if Required	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact BIO-20: Temporary Loss of Nesting Habitat for the San Pablo Song Sparrow	Significant	Mitigation Measure BIO-8: Monitor Site Development and Implement Actions to Increase the Rate of Marsh Development, if Required Mitigation Measure BIO-9: Monitor Development of Brackish Open Water, Emergent Marsh, and/or Seasonal Wetlands.	Less than Significant
Impact BIO-21: Temporary Loss of Nesting and/or Foraging Habitat for the Northern Harrier, White-Tailed Kite, and Short-Eared Owl	Less than Significant		
Impact BIO-22: Loss of Foraging Habitat for Golden Eagle and Burrowing Owl	Less than Significant		
Impact BIO-23: Temporary Loss of Foraging Habitat for Wintering Waterfowl	Less than Significant		
Impact BIO-24: Increase in Suitable Habitat for Migratory Shorebirds	Beneficial		
Impact BIO-25: Potential for spread of invasive nonnative plants within and outside of restoration area during construction activities	Significant	Mitigation Measure 10a: Prevent Spread of Perennial Pepperweed and Other Invasive Weeds to Uninfested Areas Mitigation Measure 10b: Monitor Restoration Sites and Control for Infestation by Invasive nonnative plants	Less than Significant
Impact BIO-26: Biological Benefit from Increases in Organic Carbon and Nitrogen Concentrations	Beneficial		
Impact BIO-27: Disruption of Sensitive Wildlife due to Bay Trail Construction, All Alternatives	Significant	Mitigation Measure BIO-1: Conduct Surveys to Locate Northern Harrier, White-Tailed Kite, Golden Eagle, Cooper's Hawk, Sharp-shinned Hawk, Short-Eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow Nest Sites Before Construction Is Initiated and Avoid Breeding Sites	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact BIO-28: Disruption of Sensitive Wildlife due to Public Access Interactions along the Bay Trail	Significant	Mitigation Measure BIO-11: Incorporate Wildlife-Sensitive Approaches in Bay Trail Design and Develop Trail Access Management Plan	Less than Significant
Impact BIO-29: Disruption of Sensitive Wildlife due to Public Access Interactions along the Bay Trail, Southward and Northward Extension	Significant	Mitigation Measure BIO-12: Implement Specific Design and Management Mitigation for Bay Trail Southward Extension and Northward Extension from City of Novato Levee	Less than Significant
Impact BIO-30: Changes in Predator Access	Less than Significant		
Impact BIO-31: Potential Harm to Marine Mammals, and Special-Status Fish Species, and Common Fish Species due to Pile-Driving Activities for Off-Loader Facility and Booster-Pump Platforms	Significant and Unavoidable	Mitigation Measure BIO-13: Coordinate with Appropriate Federal and State Agencies to Reduce Impact on Marine Mammals and Special-Status Fish Species during Pile-Driving Activities	Significant
Impact BIO-32: Potential Disruption to Nesting Special-Status and Common Birds due to Removal of Several Eucalyptus Groves and Several Oak Trees	Significant	Mitigation Measure BIO-14: Remove Identified Eucalyptus Groves and Oak Trees outside Special-Status and Other Bird Breeding Seasons	Less than Significant
Impact BIO-33: Potential Disruption to Special-Status Bat Species due to Removal of Structures	Significant	Mitigation Measure BIO-15: Conduct Site Surveys for Presence of Special-Status Bat Species and Remove Structures in accordance with State and Federal Laws.	Less than Significant
Impact BIO-34: Loss of Agricultural Land	Less than Significant		
Impact BIO-35: Potential Change in Habitats in Pacheco Pond and Tributaries	Less than Significant		
Impacts and Mitigation Measures Common to Alternative 1 and Revised Alternative2			
Impact BIO-36: Potential Effects of Construction of and Access to the Interpretive Center and Access Area on the "Bulge" Parcel West of the HWRP	Significant	Mitigation Measure BIO-16: Recommended Mitigation Measures for Construction of and Access to and from the Interpretive Center and Access Area on the "bulge" parcel west of HWRP.	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact BIO-37: Potential for Construction-Related Mortality of Chinook Salmon, Central Valley Steelhead, and Longfin Smelt	Less than Significant		
Impact BIO-38: Temporary Disturbance of Fish in San Pablo Bay During Construction	Significant	Mitigation Measure BIO-17: Use Fish Screens to Prevent Possible Entrainment of Fish	Less than Significant
Impacts and Mitigation Measures Unique to Alternative 1			
Impact BIO-39: Disruption of Sensitive Wildlife due to Bay Trail Construction, Alternative 1 and Spur Option 1A	Significant	Mitigation Measure BIO-18: Mitigation for Construction of Trail West of Pacheco Pond. Mitigation Measure BIO-1: Conduct Surveys to Locate Northern Harrier, White-Tailed Kite, Golden Eagle, Cooper's Hawk, Sharp-shinned Hawk, Short-Eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow Nest Sites Before Construction Is Initiated and Avoid Breeding Sites during Construction Mitigation Measure BIO-3: Avoid Operation of Equipment within 250 feet of the Outboard Tidal Coastal Marsh During the Breeding Period of the California Clapper Rail and California Black Rail and Avoid Breeding Sites during Construction Mitigation Measure BIO-5: Conduct Surveys to Locate Burrowing Owl Nest Sites before Construction Is Initiated and Avoid Breeding Sites during Construction	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact BIO-40: Disruption of Sensitive Wildlife due to Public Access Interactions along Bay Trail, Alternative 1	Significant	Mitigation Measure BIO-19a: Specific Design and Management Mitigation for Bay Trail Alternative 1 Mitigation Measure BIO-19b: Specific Design and Management Mitigation for Spur Option 1A Mitigation Measure BIO-12: Implement Specific Design and Management Mitigation for Bay Trail Southward Extension and Northward Extension from City of Novato Levee	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impacts and Mitigation Measures Unique to Revised Alternative 2			
Impact BIO-41: Disruption of Sensitive Wildlife due to Bay Trail Construction, Revised Alternative 2	Significant	Mitigation Measure BIO-1: Conduct Surveys to Locate Northern Harrier, White-Tailed Kite, Golden Eagle, Cooper's Hawk, Sharp-shinned Hawk, Short-Eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow Nest Sites Before Construction Is Initiated and Avoid Breeding Sites during Construction Mitigation Measure BIO-3: Avoid Operation of Equipment within 250 feet of the Outboard Tidal Coastal Marsh During the Breeding Period of the California Clapper Rail and California Black Rail and Avoid Breeding Sites during Construction Mitigation Measure BIO-4: Conduct Surveys to Locate San Pablo Song Sparrow Nest Sites before Construction Is Initiated and Avoid Breeding Sites during Construction Mitigation Measure BIO-5: Conduct Surveys to Locate Burrowing Owl Nest Sites before Construction Is Initiated and Avoid Breeding Sites during Construction Mitigation Measure BIO-6: Avoid Construction that Could Affect Tidal Aquatic Habitats when Salmonid Smolts Could Be Present	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact BIO-42: Disruption of Sensitive Wildlife due to Bay Trail Access, Revised Alternative 2	Significant	Mitigation Measure BIO-12: Implement Specific Design and Management Mitigation for Bay Trail Southward Extension and Northward Extension from City of Novato Levee Mitigation Measure BIO-20: Implement Specific Design and Management Recommendations for Bay Trail Revised Alternative 2.	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impacts and Mitigation Measures Unique to Alternative 3			
Impact BIO-43: Disruption of Sensitive Wildlife due to Bay Trail Construction, Alternative 3 and Spur Option 3A	Significant	Mitigation Measure BIO-1: Conduct Surveys to Locate Northern Harrier, White-Tailed Kite, Golden Eagle, Cooper's Hawk, Sharp-shinned Hawk, Short-Eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow Nest Sites Before Construction Is Initiated and Avoid Breeding Sites during Construction Mitigation Measure BIO-3: Avoid Operation of Equipment within 250 feet of the Outboard Tidal Coastal Marsh During the Breeding Period of the California Clapper Rail and California Black Rail and Avoid Breeding Sites during Construction Mitigation Measure BIO-4: Conduct Surveys to Locate San Pablo Song Sparrow Nest Sites before Construction Is Initiated and Avoid Breeding Sites during Construction Mitigation Measure BIO-5: Conduct Surveys to Locate Burrowing Owl Nest Sites before Construction Is Initiated and Avoid Breeding Sites during Construction Mitigation Measure BIO-6: Avoid construction that could affect tidal aquatic habitats	Less than Significant

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impact BIO-44: Disruption of Sensitive Wildlife due to Bay Trail Access, Alternative 3 and Spur Option 3A	Significant	Mitigation Measure BIO-21a: Specific Design and Management Mitigation for Bay Trail Alternative 3 Mitigation Measure BIO-21b: Specific Design and Management Mitigation for Trail Spur Option 3A Mitigation Measure BIO-12: Implement Specific Design and Management Mitigation for Bay Trail Southward Extension and Northward Extension from City of Novato Levee	Less than Significant
Land Use and Utilities			
No-Action Alternative			
No Impact			
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact LU-1: Consistency with Applicable City and County General Plans and Policies	Less than Significant		
Impact LU-2: Compatibility with Designated Bay Trail Routes and Effects on Existing Informal Recreational Use	Less than Significant		
Impact LU-3: Conflict with Existing Utilities and Utility Easements	Less than Significant		
Impact LU-4: Conflict with Other Existing Easements	Less than Significant		
Impact LU-5: Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Non-Agricultural Use	Less than Significant		
Impacts and Mitigation Measures Common to Alternative 1 and Revised Alternative 2			
Impact LU-6: Modifications to Morphology of Novato Creek due to Breach of BMKV/Novato Creek Levee May effect Navigation	Beneficial		

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impacts and Mitigation Measures Unique to Alternative 3			
Impact LU-7. Inconsistency with the LTMS Management Plan	Potentially Significant	No feasible mitigation measures	Potentially Significant
Hazardous Substances and Waste			
No-Action Alternative			
No Impact			
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact HAZ-1: Potential Exposure of Humans, Plants, or Wildlife to Contaminants as a Result of Remediation Activities for the Proposed Action	Significant	Mitigation Measure HAZ-1: Coordinate with Department of Toxic Substances Control on BMK Site Clean-Up Requirements prior to Construction	Less than Significant
Impact HAZ-2: Potential Exposure of Humans, Plants, or Wildlife to Hazardous Chemicals Contained in Dredged Material Used as Fill Material	Potentially Significant (See Impact WQ-1)	Mitigation Measures WQ-1: Implement Methylmercury Adaptive Management Plan	Potentially Significant
Impact HAZ-3: Potential Exposure of Humans, Plants, or Wildlife to Hazardous Chemicals Due to Sedimentation from Novato Creek and/or San Pablo Bay	Potentially Significant (See Impact WQ-1)	Mitigation Measures WQ-1: Implement Methylmercury Adaptive Management Plan	Potentially Significant
Transportation			
No-Action Alternative			
No Impact			
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact T-1: Change in LOS at Important Intersections and Roadway Segments during the Construction Phase	Less than Significant		
Impact T-2: Change in LOS at Important Intersections and Roadway Segments during the Operation Phase	Less than Significant		

Table ES-2. Continued

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Air Quality			
No-Action Alternative			
No Impact			
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact A-1: Construction-Related Emissions of PM10 from Terrestrial Construction Equipment	Significant	Mitigation Measure A-1: Control PM10 Emissions in Accordance with BAAQMD Standards	Less than Significant
Impact A-2: Construction-Related Emissions of Ozone Precursors from Terrestrial Equipment and Use of Diesel Pumps to Offload Dredge Material	Significant	Mitigation Measure A-2: Control and/or Offset NOx Emissions Associated with Unloading of Dredged Material	Less than Significant
Impacts Unique to Alternative 3			
Impact A-3: Operational Emissions of a Relief Pump	Less than Significant		
Noise			
No-Action Alternative			
No Impact			
Impacts and Mitigation Measures Common to Alternatives 1-3			
Impact N-1: Potential Increases in Traffic Noise Levels	Less than Significant		
Impact N-2: Temporary Increases in Noise Levels to More Than 60 dBA during Onshore Construction	Significant	Mitigation Measure N-1: Employ Noise-Reducing Construction Practices	Less than Significant
Impact N-3: Temporary Increase in Noise Levels due to Offshore Pile-Driving	Less than Significant		
Impacts and Mitigation Measures Common to Alternative 1 and Revised Alternative 2			
Impact N-4: Increased Noise from Use of Hydraulic Off Loaders and Supplemental Booster Pumps	Less than Significant		

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impacts Unique to Alternative 3			
Impact N-5: Increased Noise from Use of Relief Pump(s)	Significant	Mitigation Measure N-2: Employ Noise-Reducing Design if the Pump Station in Alternative 3 is Built.	Less than Significant
Cultural Resources			
No-Action Alternative			
No Impact			
Impacts and Mitigation Measures Common to Alternatives 1–3			
Impact CR-1: No impact to known significant architectural or archaeological resources	No Impact		
Impact CR-2: Potential impacts to buried cultural deposits or human remains	Significant	Mitigation Measure CR-1: Stop Work if Buried Cultural Deposits Are Encountered during Construction Activities Mitigation Measure CR-2: Stop Work if Human Remains are Encountered during Construction Activities	Less than Significant
Impacts and Mitigation Measures Unique to Alternative 1			
Impact CR-3: Potential Cultural Resource impacts resulting from construction of the Bay Trail alignment, Alternative 1	Less than Significant		
Aesthetics			
No-Action Alternative			
No Impact			
Impacts and Mitigation Measures Common to Alternatives 1–3			
Impact AE-1: Change in Aesthetic Character of BMKV Site	Less than Significant		

Impact	Significance Determination	Mitigation Measure	Significance Determination with Mitigation Incorporation
Impacts and Mitigation Measures Unique to Alternative 1			
Impact A-2: Obstruction of Existing Unobstructed Views of BMKV Site and San Pablo Bay, Alternative 1	Significant and Unavoidable	No mitigation measures available, except changes to levee heights and location as in Revised Alternative 2.	Significant
Impacts and Mitigation Measures Unique to Revised Alternative 2			
Impact AE-3: Obstruction of Existing Views of BMKV Site and San Pablo Bay, Revised Alternative 2	Less than Significant		
Impacts and Mitigation Measures Unique to Alternative 3			
Impact A-4: Obstruction of Existing Views of BMKV Site and San Pablo Bay	Significant and Unavoidable	No mitigation measures available, except changes to levee heights and location as in Revised Alternative 2.	Significant

Chapter 1
Introduction

This chapter provides a brief overview of the proposed Bel Marin Keys Unit V (BMKV) Expansion of the Hamilton Wetland Restoration Project (HWRP), describes the environmental review requirements that must be met prior to project approval; identifies the intent and scope of this document; and identifies the local, state, and federal permits expected to be necessary for project implementation.

Overview of the Proposed Wetland Restoration

The proposed BMKV expansion site is located in the San Francisco Bay Estuary in unincorporated Marin County and Novato, California (see figure 1-1). The 1,584-acre expansion site is bounded by Novato Creek and the Bel Marin Keys (BMK) residential development to the north, Pacheco Pond to the west, the authorized HWRP site to the south (which includes both the Hamilton Army Airfield [HAAF] and State Lands Commission [SLC] parcels), and San Pablo Bay to the east (see figure 1-2). An 8-acre triangular-shaped parcel located north of Bel Marin Keys Boulevard (figure 1-2) is also part of the proposed BMKV expansion site. However, no activities are proposed that would alter habitat on this site. Potential restoration-related activities that may occur on this site include control of invasive plant species. The remainder of the site where existing habitat will be changed is approximately 1,576-acres in size. The BMKV expansion site historically supported subtidal mudflat, tidal marsh, and freshwater wetland habitats. The proposed wetland restoration would return the site to seasonal and tidal wetland conditions and reestablish important ecological functions in the San Francisco Bay Estuary.

This supplemental environmental impact report/environmental impact statement (SEIR/EIS) presents an evaluation of the impacts associated with restoration of wetlands at the BMKV expansion site and the adjacent SLC parcel. Restoration at the SLC parcel is included in the authorized HWRP, but it is also included in this document because of its hydrological connection to the BMKV site and because several changes would be necessary to restoration design on the SLC parcel to integrate the BMKV site. This document is a supplement to the final EIR/EIS for the HWRP, which was certified in December 1998.

Jones & Stokes
nhc northwest hydraulic consultants

Figure 1-1
Location of the Bel Marin Keys Unit V Expansion Site

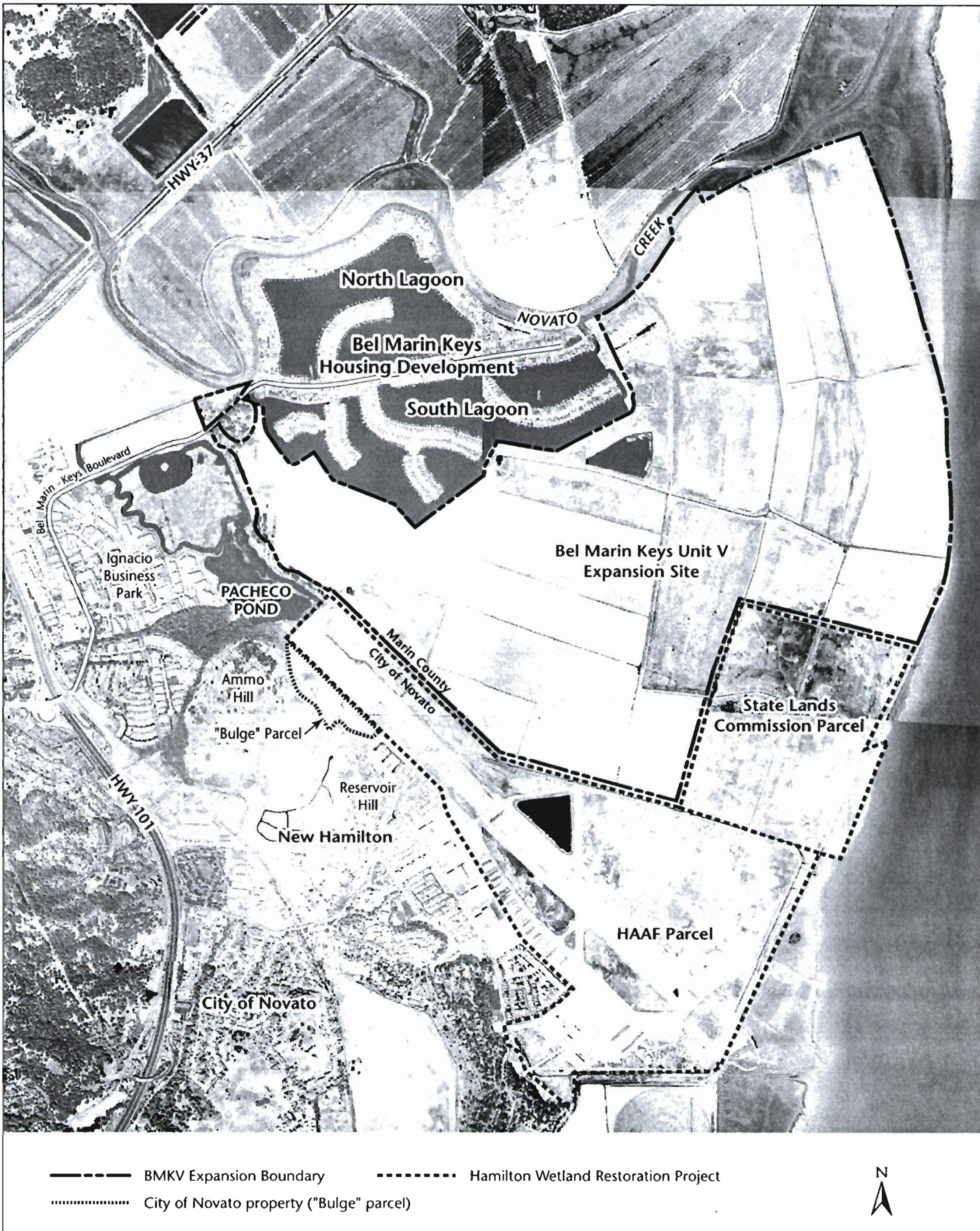

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Figure 1-2
Bel Marin Keys Unit V Expansion Site

State and Federal Agency Sponsors

The U.S. Army Corps of Engineers, San Francisco District (Corps) and the California State Coastal Conservancy (Conservancy), in collaboration with the San Francisco Bay Conservation and Development Commission (BCDC), are seeking to restore the BMKV property as an expansion of the HWRP. In 2001, the Conservancy purchased the BMKV property with the intent of including it as an expansion of the HWRP. The Corps and the Conservancy will serve as the federal and state lead agencies, respectively, for the authorized HWRP and the proposed BMKV expansion.

Overview of the National Environmental Policy Act and the California Environmental Quality Act

When a project[1] is subject to review under both the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), state and local agencies are encouraged to cooperate with federal agencies in the environmental review process and to prepare a joint environmental document. The Conservancy and the Corps have determined that the proposed BMKV expansion could significantly affect the environment and have therefore prepared this joint SEIR/EIS.

NEPA (42 United States Code [USC] 4321; 40 Code of Federal Regulations [CFR] 1500.1) is the nation's broadest environmental law. It provides an interdisciplinary framework for federal agencies to prevent environmental damage and contains action-forcing procedures to ensure that federal agency decision makers take environmental factors into account. NEPA applies to all federal agencies and to most of the activities they manage, regulate, or fund that affect the environment. It requires all agencies to consider and to publicly disclose the environmental implications of their proposed actions through the preparation of appropriate documents. The President's Council on Environmental Quality (CEQ) has adopted regulations and other guidance that provide detailed procedures that federal agencies must follow to implement NEPA. NEPA requires that every federal agency prepare an environmental impact statement (EIS) for proposed legislation or other major federal actions "significantly affecting the quality of the human environment." 42 U.S.C. 4332; 40 C.F.R. 1501.

According to the CEQ NEPA Regulations (40 CFR 15029[c][1]), a federal agency must prepare a supplement to a draft or final EIS if:

[1] The term *project* used in this SEIR/EIS refers explicitly to the term as defined under CEQ's regulations for NEPA and the State CEQA Guidelines: "the entirety of an action which has a potential for resulting in a physical change in the environment." The Corps defines *project* as "an action that has been authorized by Congress," such as the HWRP. The BMKV expansion has not been authorized by Congress.

- the federal agency makes substantial changes in the proposed action that are relevant to its environmental effects, or
- there are significant new circumstances or information relevant to the environmental concerns that bear on the proposed action.

In addition, federal agencies have the discretion to prepare a supplement to an EIS in any circumstance in which they determine that such a supplement would further the purposes of NEPA (40 CFR 1502.9[c][c]). This SEIR/EIS was prepared to comply with the requirements of NEPA and its relevant implementing regulations.

CEQA requires state and local agencies to estimate and evaluate the environmental implications of their actions and aims to prevent adverse environmental impacts of those actions by requiring those agencies, when feasible, to avoid or reduce significant environmental impacts. CEQA requires that the lead agency prepare an environmental impact report (EIR) when the lead agency determines that a project may have a significant effect on the environment.

According to CEQA Guideline 15162, a supplemental EIR must be prepared if the agency with continuing discretionary authority over the project determines on the basis of substantial evidence in light of the whole record that:

- substantial changes proposed in the project will require major revisions to the previous EIR because of the involvement of new significant environmental effects or a substantial increase in the severity of previously identified effects,
- substantial changes occur with respect to the circumstances under which the project is undertaken that will require major revision of a previous EIR because of the involvement of new significant environmental effects or a substantial increase in the severity of previously identified effects, or
- new information of substantial importance that was not known or could not have been known without exercise of reasonable diligence at the time the previous EIR was certified.

The 1998 EIS/EIR for the HWRP studied the incorporation of the BMKV site into the HWRP at a programmatic level. The feasibility study for the HWRP stated that the BMKV site had a high potential to substantially increase the amount of land available for wetland restoration (U.S. Army Corps of Engineers 1998). However, the selected alternative for the 1998 HWRP did not include BMKV because the site was privately owned at that time. The Conservancy purchased the site in 2001, with the intent of proposing wetland restoration at the site, in cooperation with the Corps. This SEIR/EIS was prepared to comply with the requirements of CEQA, NEPA and their relevant implementing regulations.

Public Involvement and Scoping

The intent of both NEPA and CEQA is to establish opportunities for the public to review and comment on projects that may affect the environment. Both NEPA and CEQA provide for public participation through:

- project scoping,
- publication of project Notice of Intent/Notice of Presentation,
- public review of environmental documents, and
- public hearings.

NEPA and CEQA also require that a final EIS/EIR include responses to all comments received from the public regarding the draft EIS/EIR. The following sections provide additional information on public involvement in the environmental review process.

Project Scoping

Scoping refers to the process used under both NEPA and CEQA to determine the focus and content of an EIS/EIR. Scoping identifies the range of project alternatives and mitigation measures to be analyzed in depth. Scoping is also helpful in establishing methods of assessment and in selecting the environmental effects to be considered in detail. Tools used in scoping of this SEIR/EIS included early public and interagency consultation, public scoping meetings, and publication of the project Notice of Intent (NOI) and Notice of Preparation (NOP).

Notice of Preparation and Notice of Intent

The purpose of the NOI and NOP is to solicit participation in determining the scope of an EIS/EIR from responsible and coordinating federal, state, and local agencies and from the public. The lead agencies formally initiated the scoping process for this SEIR/EIS in November 2001 by submitting the NOP to the California State Clearinghouse in compliance with CEQA and publishing the NOI in the Federal Register in compliance with NEPA. In addition, a notification letter was distributed to all interested agencies, organizations, and members of the public. The public scoping period for this document ended December 31, 2001.

Public Scoping Meetings

During the restoration planning process, the lead agencies held 2 public meetings to introduce interested members of the public to the project and to solicit public input. These meetings were held on September 25, 2001 and December 5, 2001. The initial public meeting provided the public with an opportunity to meet the project sponsors, to review and discuss the project goals and objectives, and to provide input on site-related opportunities and constraints. The second public meeting provided a forum for discussion of alternative restoration concepts and potential environmental issues, and served as a formal scoping meeting for the environmental compliance process. Public comments received at these meetings were recorded for consideration during the restoration planning process. In addition, participants at the second public meeting were encouraged to submit written comments to the project sponsors during the public comment period.

Distribution and Review of the Draft SEIR/EIS

The lead agencies submitted a notice of intent to the federal register and a notice of preparation to the California State Clearinghouse and interested parties announcing the availability of this draft SEIR/EIS for a 45-day public review and comment period. The public review and comment period was held from July 19, 2002, through September 2, 2002. The lead agencies extended the comment and review period through September 13, 2002, in order to allow sufficient time for all comments to be submitted. During this period, state and federal regulatory agencies, local government agencies, and members of the public reviewed the Draft SEIR/EIS and submitted comments on the document to the lead agencies. Additionally, the lead agencies held a public meeting on August 21, 2002, in Marin County to solicit any verbal comments on the Draft SEIR/EIS.

Final SEIR/EIS

Following the public review and comment period, the Conservancy and the Corps collated and addressed all environmental comments received on the Draft SEIR/EIS. Pursuant to CEQA and NEPA, the agencies prepared responses to these comments and revised the Draft SEIR/EIS where substantive comments required changes or refinements to the analysis. The comments on the Draft SEIR/EIS and the responses to these comments are presented in Responses to Comments for the Final SEIR/EIS. Changes to the text of the Draft SEIR/EIS are noted in the Responses to Comments and made in the text of the Final SEIR/EIS. While CEQA requires incorporation of responses to comments in a final EIR and provision of those responses to commenting public agencies prior to certification of a final EIR, it does not require a formal public comment period on a final EIR. However, pursuant to NEPA, the lead agencies will circulate the Final SEIR/EIS for a 30-day review and comment period prior to the certification of the SEIR/EIS and filing of a Record of Decision.

Intent and Scope of this SEIR/EIS

Intent

The intent of this SEIR/EIS is to:

- identify potential direct, indirect, and cumulative environmental impacts associated with the proposed wetland restoration project;
- describe mitigation measures intended to avoid potentially significant project impacts or reduce them to a less-than-significant level; and
- disclose potential project impacts and proposed mitigation measures for public review and comment.

This SEIR/EIS is also intended to supply the information necessary to support additional permit application and review processes related to this project.

Scope

This SEIR/EIS describes the features of the proposed BMKV expansion and restoration alternatives, including the No-Project Alternative, under which current management of the expansion site would continue and existing conditions would remain generally unchanged. As required by NEPA and CEQA, it evaluates the potential impacts of the proposed BMKV expansion and all restoration alternatives on the following resource topics.

- Geology, soils, and seismicity
- Surface-water hydrology and tidal hydraulics
- Water quality
- Public health
- Biological resources
- Land use and public utilities
- Hazardous substances and waste
- Transportation
- Air quality
- Noise
- Cultural resources
- Aesthetics

The study area addressed in this SEIR/EIS includes the BMKV parcel (figure 1-1) and the adjacent SLC parcel (figure 1-2), as well as Pacheco Pond, Novato Creek, and surrounding areas. In addition to effects on the BMKV site itself and surrounding environments, this document analyzes the environmental effects of the proposed BMKV expansion on the SLC parcel for specific resource topics. The SLC parcel is already part of the authorized HWRP, but the BMKV expansion would include several restoration design changes to the SLC parcel, and thus the effects of these changes are described in this document. For some resource topics (e.g., biological resources, hydrology, and water quality), this document also discusses conditions in the larger San Francisco Bay watershed. The terms *expansion area* and *expansion site* are used interchangeably throughout this document to refer to the location of the proposed wetland restoration activities on the BMKV parcel itself. The SLC parcel is referred to separately since it is already part of the authorized HWRP. Areas outside of the BMKV parcel or SLC parcel (such as Novato Creek) that may be affected by proposed activities are referenced by location.

List of Local, State, and Federal Permits

The local, state, and federal permits and other approvals expected to be necessary for implementation of this project are listed in table 1-1. The local and state public agencies listed in table 1-1 are considered responsible agencies as defined in CEQA and would use the analysis in this document when considering issuance of the permits identified in the table. The federal agencies would use the analysis in this document when completing NEPA compliance for the identified permits.

Table 1-1. List of Local, State, and Federal Permits and Other Approvals Expected for the BMKV Expansion of the HWRP

Agency	Jurisdiction Related to Project	Areas of Jurisdiction Related to Project	Approvals/Permits
LOCAL/REGIONAL			
Marin County Department of Planning and Building Services	Marin Countywide Plan	BMKV	Determination of consistency with General Plan and zoning.
	Marin Zoning Code	BMKV	
Marin County Department of Public Works	F1 and F2 Zoning Ordinances	BMKV	Determination of consistency with F1 and F2 zoning
Flood Control and Water Conservation District (MCFCWCD)	1980 and 1987 Drainage Easements	BMKV	Amendment of existing drainage agreements on BMKV
	Ownership of Pacheco Pond	Pacheco Pond	Encroachment permits for work on MCFCWCD land and approval of easement for Bay Trail if proposed on MCFCWCD land.
			Amendment of existing DFG–MCFCWCD management agreement for Pacheco Pond
City of Novato	Ownership of land west of HWRP	Portions of Bay Trail on city-owned land (Alt. 1 only)	Construction of Bay Trail on city-owned land (Alt. 1 only)
	Novato General Plan Novato Zoning Code	Portions of Bay Trail within City of Novato	Approval of Bay Trail where proposed by construction by others on areas within city jurisdiction
Bel Marin Keys Community Services District (BMK CSD)	Levee maintenance easement	BMK south lagoon levee	Potential Amendment of levee maintenance easement
	1997 Drainage agreement	BMK south lagoon levee culvert for drainage onto BMKV	Amendment of 1997 Drainage Agreement
Novato Sanitary District (NSD)	Sanitary outfall easement	Outfall easement	Amendment of outfall easement Replacement or retrofit of outfall
STATE			
California State Coastal Conservancy (Conservancy)	Ownership of site/Project Sponsor	BMKV	Approval and funding of project

Agency	Jurisdiction Related to Project	Areas of Jurisdiction Related to Project	Approvals/Permits
	Conservancy authorizing legislation		
San Francisco Bay Conservation and Development Commission (BCDC)	McAteer-Petris Act/ San Francisco Bay Plan	Areas within 100 feet of Bay and tidal reach of Novato Creek	Permit approval for project.
	Coastal Zone Management Act (CZMA)		Review of federal permit for consistency
	LTMS cooperating agency	Use of dredged material	DMMO determinations of suitability
Bay Area Air Quality Management District (BAAQMD)	Construction emissions	Project Area	Potential Permits for Diesel Off-loading and Booster Pumps
			Review of conformity analysis
San Francisco Regional Water Quality Control Board (SFRWQCB)	Porter-Cologne Water Quality Control Act	Water Quality/Discharge	Waste Discharge Requirements for Construction
	Clean Water Act Section 401	Existing U.S. wetlands/waters	CWA Section 401 certification of Corps permit
	Clean Water Act Section 402	Stormwater runoff	Stormwater Pollution Prevention Plan (SWPPP)\
	LTMS cooperating agency	Use of dredged material	DMMO determinations of suitability
California Department of Fish and Game (DFG)	California Endangered Species Act (CESA)	BMKV	Memorandum of Agreement (MOA) if listed state species affected by project
	California Fish and Game Code	Novato Creek	Streambed Alteration Agreement (1603) for alterations to Novato Creek
	Pacheco Pond	DFG	Amendment of existing DFG-MCFCWCD management agreement for Pacheco Pond.
California Department of Toxic Substances and Control (DTSC)	Potentially contaminated sites	BMKV	Approval of remediation plans for identified areas of contamination, if needed.

Table 1-1. Continued

Agency	Jurisdiction Related to Project	Areas of Jurisdiction Related to Project	Approvals/Permits
State Historical Preservation Office (SHPO)	National Historic Preservation Act (NHPA), Section 106	Potential archeological and historical sites	Review of Corps Section 106 report.
FEDERAL			
U.S. Army Corps of Engineers (Corps)	Project Sponsor	BMKV	Corps Approval of Project
	Clean Water Act Section 404	BMKV Pacheco Pond Novato Creek	Section 404 Review
	Rivers and Harbors Act of 1899, Section 10	BMKV Novato Creek San Pablo Bay	Section 10 Review
	LTMS Cooperating Agency	Use of dredged material	DMMO determinations of material suitability
U.S. Fish and Wildlife Service	Federal Endangered Species Act (FESA)	Locations/habitat for listed federal species	ESA Section 7 Consultation
	Fish and Wildlife Coordination Act (FWCA)	Project area	Coordination Act Report (CAR)
National Marine Fisheries Service	Federal Endangered Species Act (FESA)	Locations/habitat for listed federal species	ESA Section 7 Consultation
	Marine Mammal Protection Act (MMPA)	San Pablo Bay	MMPA Consultation
	Fish and Wildlife Coordination Act (FWCA)	Project Area	Coordination Act Report (CAR)
	Magnuson Fisheries Conservation Act (MFCA)	Essential Fish Habitat (San Pablo Bay and Novato Creek)	EFH Consultation

Table 1-1. Continued

Agency	Jurisdiction Related to Project	Areas of Jurisdiction Related to Project	Approvals/Permits
U.S. Coast Guard	Rivers and Harbors Act of 1899, Section 9	San Pablo Bay	Review of any potential structures within navigable waters (e.g. off-loading and booster pump platforms and unloading pipeline).
U.S. Environmental Protection Agency (EPA)	LTMS cooperating agency	Use of dredged material	DMMO determinations of material suitability
Natural Resources Conservation Service (NRCS)	Farmland Protection Policy Act	BMKV farmlands	Federal lead agency (Corps) responsible to consult with NRCS and complete of land evaluation and site assessment
Advisory Council on Historic Preservation	National Historic Preservation Act (NHPA), Section 106	Potential archeological and historical sites	Review of Corps Section 106 report.

LTMS = Long-Term Management Strategy for Disposal of Dredged Material in San Francisco Bay
DMMO = Dredged Material Management Office

Chapter 2
Purpose and Need

CEQA requires an EIR to contain a statement of the objectives sought by the project proponents. Similarly, NEPA requires an EIS to briefly describe the underlying purpose and need for the action and alternatives proposed by the lead agency. This chapter describes the state and federal authority under which the proposed BMKV expansion is being developed, the purpose and need for the expansion, the goals and objectives, and the relationship of the BMKV expansion to other projects and plans.

Statutory Authority

The Conservancy is the state lead agency for the proposed BMKV expansion. The Conservancy was created by the state legislature for the purpose of developing and sponsoring environmental projects[1] that protect, preserve, and enhance coastal resources along the 1,100-mile California coastline and around San Francisco Bay. The Conservancy's broad authority enables its participation in a diverse array of projects involving habitat creation, enhancement, and restoration. In 2001, the Conservancy purchased the BMKV property with the intent of including it as an expansion of the Hamilton Wetland Restoration Project.

The Corps is the federal lead agency for the proposed BMKV expansion. The Corps is authorized under Section 204 of the Water Resources Development Act of 1992 (33 USC 2326) to carry out projects for the protection, restoration, and creation of aquatic and ecologically related habitats, including wetlands, in connection with dredging for construction, operation, or maintenance of an authorized navigation project. Under this authority, such projects may be undertaken if the environmental, economic, and social benefits of the project justify the cost thereof, and if the project would not result in environmental degradation. The Corps is authorized under the Water Resources Development Act (WRDA) of 1999 to implement the HWRP, in cooperation with the Conservancy as the non-federal sponsor.

[1] The term *project* used in this SEIR/EIS refers explicitly to the term as defined under CEQ's regulations for NEPA and the State CEQA Guidelines: "the entirety of an action which has a potential for resulting in a physical change in the environment." The Corps defines *project* as "an action that has been authorized by Congress," such as the HWRP. The BMKV expansion has not been authorized by Congress.

The Corps prepared a Section 204 Initial Appraisal Report (IAR) in September 2000 for the proposed BMKV expansion of the HWRP. The IAR recommended that a study of the BMKV parcel be incorporated into the ongoing authorized HWRP. A General Reevaluation Report (GRR) has been developed by the Corps to determine whether a potential federal interest exists in the BMKV parcel. If the GRR finds that a potential federal interest exists, then a request for re-authorization of the HWRP project will be recommended.. Based on the findings of the GRR, Congress will determine whether the proposed expansion is in the federal interest. If authorized by Congress, the BMKV expansion will become an addition to the HWRP. The GRR is not part of the SEIR/EIS; copies of it have been provided at the local libraries listed in Chapter 7. The GRR is also available upon request from the Corps (Contact: Eric Jolliffe, U.S. Army Corps of Engineers, San Francisco District, 333 Market Street., 7th Floor, San Francisco, CA 94105; ejolliffe@spd.usace.army.mil; (415) 977-8543).

BCDC has been working closely with the Conservancy and Corps in planning and design for both the HWRP and the BMKV expansion as part of the design teams for these efforts. BCDC's dredging policies call for the beneficial reuse of dredged material and the restoration of diked bayland areas to tidal wetlands. Additionally, BCDC is a responsible state agency for the proposed BMKV expansion. The McAteer–Petris Act, passed by the State of California in 1965, established BCDC as the state agency responsible for regulating development in and around San Francisco Bay and mandated the planning effort that resulted in the development of the San Francisco Bay Plan. BCDC is a responsible agency for the proposed expansion because of its interest in implementing the San Francisco Bay Plan and because it will ultimately be called upon to issue a permit for the expansion and confirm that the expansion is implemented in compliance with the San Francisco Bay Plan.

Purpose and Need

The purpose of the proposed BMKV expansion is to restore important tidal wetland habitat in San Francisco Bay. Approximately 90% of the original tidal wetlands of San Francisco Bay have been destroyed. This destruction is the result of the diking and filling of the tidal wetlands for purposes of agriculture, urban development, and salt production. This loss of tidal wetlands has greatly reduced the amount of habitat available to many species of fish and wildlife. Several local animal and plant species, including the salt marsh harvest mouse and the California clapper rail, have been listed as in danger of extinction, or endangered, as a direct result of the reduction in extent and quality of their wetland habitats. Many other species, including migratory birds and numerous fish species, also have been affected by this loss of habitat. Restoration of tidal salt marsh habitat at the BMKV property represents the implementation of local, regional, and national planning efforts described below under *Relationship of the Proposed BMKV Expansion to Other Projects and Plans*. The need for wetland restoration is demonstrated by the high amount of wetland loss around the Bay, historically; the limits on the ability of existing habitat to support fish and

wildlife, in particular threatened and endangered species; and the recognition of the values of wetlands in local, regional, and national planning efforts.

In addition, the BMKV expansion would fulfill a need for the beneficial reuse of dredged material, which would in turn facilitate other authorized and proposed maritime navigation projects in San Francisco Bay and would further implement the Long-Term Management Strategy for Disposal of Dredged Sediments in San Francisco Bay (LTMS). The disposal of dredged material from San Francisco Bay is currently constrained by physical, environmental, and regulatory limits on the use of existing disposal sites. To the extent that dredged material is used beneficially, the need for unconfined aquatic disposal and other disposal methods, and the impacts associated with those methods, will be reduced. Restoration of tidal wetlands on subsided diked lands using dredged material provides an opportunity to offset historic habitat losses and beneficially reuse suitable dredged material.

Goal and Objectives

In 1996, the National Marine Fisheries Service (NMFS) convened a group of federal and state agency representatives to explore the concept of restoring the HAAF site to tidal wetlands. This group was later expanded into the Hamilton Restoration Group, an advisory body composed of representatives from the City of Novato, state and federal agencies, local landowners, environmental and local interest groups, and other interested parties.

The project goal and objectives of the BMKV expansion presented in this section are derived from the authorized HWRP.

Project Goal

The goal of the proposed BMKV expansion is to create a diverse array of wetland and wildlife habitats at the BMKV and HAAF sites that benefit endangered species as well as other migratory and resident species.

Project Objectives

- To design and engineer a restoration project that stresses simplicity and has little need for active management.
- To demonstrate the beneficial use of dredged material, if feasible.
- To recognize existing opportunities and constraints, including the runway and remediation of contaminated areas of the HWRP, as integral components of design.

- To ensure no net loss of wetland habitat presently provided at the BMKV and HAAF sites.
- To create and maintain wetland habitats that sustain viable wildlife populations, with particular emphasis on supporting Bay Area special-status species.
- To include buffer areas along the upland perimeter of the project area, especially adjacent to residential areas, so wildlife will not be impacted by adjacent land uses.
- To be compatible with adjacent land uses and wildlife habitats.
- To provide for public access that is compatible with protection of resource values and with regional and local public access policies.

Relationship of the Proposed Bel Marin Keys Unit V Expansion to other Projects and Plans

The proposed BMKV expansion implements, integrates, or is related to the following local, regional, and national planning efforts.

Hamilton Wetland Restoration Project

The authorized HWRP site is located immediately south and southeast of the BMKV expansion site. The 950-acre HWRP site comprises 3 areas: Hamilton Army Airfield, currently being decommissioned by the Department of the Army; the Navy ballfield site; and the SLC parcel (also known as the Antenna Field), which is owned by the State of California and administered by the SLC. A large portion of the site was historically tidal wetlands. The HWRP would return the site to seasonal and tidal wetland conditions. An EIS/EIR was completed for the HWRP in 1998, and the HWRP was authorized under WRDA 1999. The HWRP is presently in final engineering design, and initial construction started with the construction of the dredged material pipeline in January 2002.

The EIS/EIR for the HWRP studied the incorporation of the BMKV site into the HWRP at a programmatic level. The feasibility study for the HWRP identified the BMKV site as having a high potential to substantially increase the amount of land available for wetland restoration.

The HWRP would ultimately restore approximately 950 acres of habitat, including the creation of 570 acres of new tidal wetlands. The alternatives described in chapter 3 of this document could add 1,576 acres of habitat to the HWRP, including between 882 and 1,257 acres of new tidal marsh, depending on the alternative chosen.

These alternatives include, in addition to adding the expansion area itself, the following potential changes to the authorized HWRP.

- Eliminating a separating levee between the BMKV and SLC sites
- Replacing the barrier levee between BMKV and HAAF with an access berm for the NSD line
- Extending the Bay Trail southward and northward from the City of Novato levee
- Potentially using diesel off-loading and booster pumps for offloading dredged material
- Potentially using alternative alignment of pipeline directly from the off-loading facility to the BMKV site (Alternatives 1 and 2 only)
- Changing location of and increasing high transitional marsh on the SLC parcel
- Repositioning the tidal breach on SLC to BMKV (Alternatives 2 and 3)
- Adding new NSD pipeline around east side of expanded Pacheco Pond

San Francisco Bay Plan

The San Francisco Bay Plan was prepared to guide the future protection and use of the San Francisco Bay and its shoreline. The federal Coastal Zone Management Act of 1972 encourages states to voluntarily develop coastal management plans (CMPs) to preserve and protect the unique features of each coastal area. BCDC is the state coastal management agency for the San Francisco Bay segment of the coastal zone, and its laws and policies constitute the federally approved state coastal management program for the Bay.

In 1996, BCDC amended the San Francisco Bay Plan as it relates to HAAF. The San Francisco Bay Plan designates wildlife priority use for HAAF through the development of a comprehensive wetland habitat plan and a long-term management program to restore and enhance wetland habitat in diked former wetlands. The plan also indicates that dredged materials should be used whenever feasible and environmentally acceptable to facilitate wetland restoration.

In April, 2002, BCDC amended the findings and policies of the San Francisco Bay Plan regarding marshes and mudflats, fish and wildlife, and dredging. These amendments added identification of "areas diked from the Bay (that) have high-value wildlife habitat and restoration potential" to the Bay Plan maps. The amendments also included a Bay Plan policy of "where and whenever possible, former tidal marshes and tidal flats that have been diked from the Bay should be restored to tidal action in order to replace lost historic wetlands or should be managed to provide important Bay habitat functions, such as resting, foraging,

and breeding habitat for fish, other aquatic organisms and wildlife." Current maps of the San Francisco Bay Plan include a BCDC suggestion of the "possible use of Bel Marin Keys Unit V as a wetland restoration site using dredged material."

Long-Term Management Strategy for Disposal of Dredged Sediments in San Francisco Bay

For many years, dredged material taken from federal and port channels and berthing areas was removed from the bottom of San Francisco Bay, placed in barges, transported to one of the federally designated areas in the bay or ocean, and dumped. As a result of the controversy over the environmental impacts of this practice on the stressed Bay estuary and the limited capacity at the main in-Bay disposal site near Alcatraz Island, new practices were adopted in the late 1980s by the agencies with authority over dredging and disposal operations for large, new work projects.

An interagency cooperative effort, the LTMS was established in 1991 to resolve disposal issues. The goals of the LTMS include disposing dredged material in the most environmentally sound manner and maximizing the use of dredged material as a resource. The LTMS agencies have agreed on a strategy of decreasing in-Bay disposal over time, with a goal of only 20% of Bay-dredged material being disposed in the Bay. The other 80% of the dredged material is proposed to be used as a resource or disposed of at the U.S. Environmental Protection Agency (EPA)-designated deep-ocean disposal site. This approach is intended to reduce the risk of adverse impacts from in-Bay disposal while maximizing environmental benefits through reuse and providing greater certainty regarding disposal options to dredging project sponsors.

Beneficial reuse sites for dredged material will be needed to achieve this goal. The "Record of Decision" for the LTMS EIS was signed in July 1999, committing the Corps to implementing beneficial reuse options. The Corps signed the LTMS Management Plan in January 2002. Both the HAAF and BMKV properties were evaluated as part of a comprehensive review by the LTMS agencies as potential sites for reuse. Both sites were found to be highly feasible for wetland restoration using dredged material.

San Francisco Estuary Project Comprehensive Conservation and Management Plan

The San Francisco Estuary Project was established by Congress through the National Estuary Program. The San Francisco Estuary Project promotes consensus on how wetlands should be protected, regulated, and restored throughout the San Francisco Bay Estuary region. A Comprehensive

Conservation and Management Plan (CCMP) for the Bay and Delta, completed in 1993, provides a comprehensive implementation strategy describing various actions to protect the estuary of San Francisco Bay. The proposed BMKV expansion meets several of the objectives and recommended actions listed in the CCMP, including the reuse of dredged material for wetland creation and restoration, levee restoration, landfill cover, and upland building material, where environmentally acceptable.

Ecosystem Restoration Program Plan

A framework agreement was signed by various state and federal agencies under the interagency CALFED Bay–Delta Program (CALFED) to address various problems in the San Francisco Bay/Sacramento–San Joaquin River Delta (Bay–Delta) region. The agreement provided a combination of state and federal funding for 3 specific purposes: the development of water quality standards (Category I), water projects (Category II), and habitat restoration (Category III). Category III funding is earmarked for projects that benefit targeted species, particularly endangered fish and marsh species.

CALFED produced a draft Ecosystem Restoration Program Plan that describes the important ecological processes, habitats, species, and stressors of the San Francisco Bay ecosystem. The plan includes "ecological zone visions" for each watershed area that address the potential for restoration in each zone. The authorized HWRP and the proposed BMKV expansion were determined to be consistent with the visions and policies presented in the draft Ecosystem Restoration Program Plan, and received CALFED Category III funding.

San Francisco Estuary Baylands Ecosystem Goals Project

The San Francisco Bay Area Wetlands Ecosystem Goals Project (Goals Project) was a 5-year volunteer collaborative effort completed in 1998. Sponsored by a group of agencies that included EPA, the California Department of Fish and Game (DFG), and the Regional Water Quality Control Board (RWQCB), it involved more than 100 scientists from federal, state, and local agencies, as well as private consulting firms and universities. The results of the Goals Project address a 9-county area that encompasses the entire estuary downstream of the Delta.

The Goals Project is intended to provide guidance to public and private stakeholders interested in restoring and enhancing the wetlands and related habitats of the San Francisco Bay estuary system. It is an informational document that recommends the types, areal extent, and distribution of habitats needed to sustain diverse and healthy ecosystems in the San Francisco Bay estuary system. Recommendations are presented by region, subregion, and

segment. Regionwide goals include restoration of large patches of tidal marsh connected by corridors to enable the movement of small mammals and marsh-dependent birds; restoration of large complexes of salt ponds for the management of shorebirds; and expansion of large areas of managed marsh. The BMKV and SLC sites are identified in this plan as key areas for tidal marsh restoration.

The Goals Project describes key bayland habitat acreage goals for each subregion. The majority of the acreage in the North Bay Subregion was historically tidal marsh. The goals for the North Bay Subregion call for increasing the area of tidal marsh from the existing 16,000 acres to approximately 38,000 acres, and creating about 17,000 acres of diked wetlands managed to optimize their seasonal wetland functions (Goals Project 1999).One of the specific recommendations is to "restore a wide, continuous band of tidal marsh along the bayfront between Black Point and Gallinas Creek." The unique restoration benefits for this area include the following:

- Restoring tidal marshes on the bayshore and along lower reaches of streams would expand suitable habitat for many tidal marsh species, particularly California clapper rail.

- Restoring and improving tidal marsh along Novato Creek would . . .expand habitat for sensitive tidal marsh species (Goals Project 1999).

Marin Countywide Plan

The Marin Countywide Plan is a long-range comprehensive plan that governs growth and development in the unincorporated areas of Marin County. The proposed BMKV expansion site falls within this jurisdiction.

The BMKV site is located within the City-Centered Corridor planning area of Marin County and is designated for agricultural and conservation land uses. The BMKV site is zoned within the Bayfront Conservation Zone, which is intended to preserve, protect, and enhance existing species and habitat diversity in the county.

City of Novato General Plan

The City of Novato General Plan is a comprehensive long-range planning document that identifies the city's land use, transportation, environmental, economic, fiscal, and social goals and policies as they relate to the conservation and development of land in Novato. The HAAF and SLC parcels are located within the jurisdiction of the City of Novato and are designated in the General Plan for open space. The allowable uses within this land use category include uses devoted to, among other purposes, the preservation of natural resources and outdoor education. In addition, the General Plan states that the City of Novato

should "encourage wetlands restoration where appropriate." The plan also states that "restoration of historic wetlands such as those at the Hamilton Field runway is contributing towards restoring those lands that experienced significant loss (over 80 percent) in the bay area" (City of Novato 2000).

Bay Trail Plan

The Bay Trail Plan's main goal is to ensure the provision of public access to the Bay and its surrounding lands. The Bay Trail is a planned recreation corridor that will provide some 400 miles (640 kilometers) of biking and hiking trails. A proposed segment of the bay trail follows Perimeter Road, located on the levee that separates the BMKV site from the HAAF site, and connects with Bel Marin Keys Boulevard. The Bay Trail Plan is legally mandated by Senate Bill 100, which was adopted by the State Legislature in 1987. The Bay Trail Plan was adopted by the Association of Bay Area Governments Executive Board in 1989 and has been incorporated into the City of Novato and County of Marin General Plans. In general, implementation of the Bay Trail Plan relies on implementation by local government and other agencies.

Oakland Harbor Navigation Improvement (50-Foot) Project

The Port of Oakland has adopted a plan to deepen the federal channels of the Oakland Harbor and port-maintained berths to a depth of 50 feet below mean lower low water to accommodate the newest generation of deep-draft container ships. The project was authorized (Water Resources Development Act 1999) and would involve the dredging and disposal of 12 to 14.5 million cubic yards of bottom sediments. The Final EIR/EIS for the Oakland Harbor Navigation Improvement (50-Foot) Project identifies the preferred alternative, which involves dredging to 50 feet, with sediment reuse/disposal at various sites, including the HAAF restoration site.

Defense Base Closure and Realignment Act of 1988

The Defense Base Closure and Realignment Act of 1988 (BRAC I, Public Law 100-526) required the closure and disposal of various military properties and facilities still in military ownership, including HAAF and the Navy Ballfields parcel. During the BRAC process, disposal of the property could be accomplished through a Public Benefit Discount Conveyance, through which state or local entities could obtain property at less than fair market value when supported by a federal agency (in the case of HAAF/Navy Ballfields, the U.S. Fish and Wildlife Service [USFWS]) for uses that would benefit the public.

The U.S. Army intends to transfer the HAAF BRAC parcel to the Conservancy. The U.S. Navy intends to transfer the Navy Ballfields parcel to the Conservancy. A condition of this transfer is remediation of contamination at the site. Consequently, HAAF and the Navy Ballfields are undergoing investigation and remediation of contaminated areas. All sites known to be contaminated will be remediated by the U.S. Army and U.S. Navy to levels that meet federal, state, and local regulations that are appropriate to the proposed wetland reuse. The HAAF BRAC parcel and the Navy Ballfields BRAC parcel comprise a portion of the authorized HWRP. The BMKV expansion would not take place on the HAAF BRAC parcel or the Navy Ballfields parcel, but the BMKV property is directly adjacent to these areas . The BRAC process for HAAF/Navy Ballfields is currently at the draft Record of Decision/Remedial Action Plan phase. The suite of actions considered as part of the BMKV expansion includes no changes in the wetland design for the HAAF or Navy Ballfields parcels and no determinations regarding remedial actions at these areas. The BMKV expansion presumes that the BRAC process will result in remediation of the HAAF parcel and the Navy Ballfields parcel to a condition suitable for the proposed wetland reuse.

If the remedial determinations ultimately made through BRAC required changes in the wetland designs proposed for the HAAF parcel, the BMKV and HWRP lead agencies would evaluate the potential effects of the changes and determine whether additional NEPA/CEQA compliance would be necessary. Currently, the lead agencies consider it speculative to assume that the BRAC process will not result in remedial options that leave the HAAF or Navy Ballfields parcels suitable for the proposed wetland use.

Formerly Used Defense Site Remediation at SLC Parcel

The SLC parcel was transferred from the Department of Defense (DoD) in 1974. Environmental cleanup of the site falls under the Formerly Used Defense Site (FUDS) program. The FUDS program is an element of the Defense Environmental Restoration Program (DERP) (10 USC 2701 et seq.), and requires remediation of contaminated sites consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The objective of the FUDS program is to reduce, in a timely and cost-effective manner, the risk to human health, safety, and the environment resulting from past DoD activities. The SLC parcel is currently in the feasibility study/risk assessment phase. The FUDS program is administered by the Sacramento District of the Corps under contract to the U.S. Army, and is a separate and distinct program from the program responsible for the wetland habitat restoration at HAAF. After a Record of Decision is agreed to by DoD and federal and state regulators, any remaining cleanup will be conducted. The suite of actions considered as part of the BMKV expansion makes no determinations regarding remedial actions at the SLC parcel. The BMKV expansion presumes that the

FUDS process will result in remediation of the SLC parcel to a condition suitable for the proposed wetland reuse. Resolution of contaminant issues at the SLC site would need to be completed prior to restoration activity in the areas of identified contamination.

If the remedial determinations ultimately made through FUDS required changes in the wetland designs proposed for the SLC parcel, the BMKV and HWRP lead agencies would evaluate the potential effects of the changes and determine whether additional NEPA/CEQA compliance would be necessary. Currently, the lead agencies consider it speculative to assume that the FUDS process will not result in remedial options that leave the SLC parcel suitable for the proposed wetland use.

Chapter 3
Description of Alternatives

Introduction and Summary

The Conservancy and the Corps are proposing to restore wetlands at the BMKV site as an addition to the HWRP already authorized for implementation on the adjacent HAAF and SLC parcels. The HWRP project objectives described in chapter 2 could be attained on the BMKV expansion site by restoring wetlands in either of 2 ways: allow the natural process of sedimentation to establish the desired elevation on the expansion restoration site, or actively place dredged materials as fill to establish the desired elevation. Based on these approaches, the Conservancy and the Corps are considering the following restoration alternatives in this document.

- Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond
- Revised Alternative 2 (Preferred Alternative) – Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond
- Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond

As required by CEQA and NEPA, the No-Action (or No-Project) Alternative is also evaluated.

This chapter describes the 3 action alternatives selected for analysis in this document. The alternatives and alternative features considered during the design process but dismissed from further consideration are discussed at the end of this chapter. It should be noted that a number of changes were made to Alternative 2 between the Draft and Final SEIR/EIS. These changes were made after consideration by the Corps and the Conservancy of the comments provided by agencies, individuals, and organizations on the Draft SEIR/EIS, and after review of the project goal and objectives. No changes were made to Alternatives 1 or 3 between the Draft and Final SEIR/EIS.

The authorized HWRP is not discussed directly in this chapter, except as it relates to the changes included in the BMKV Expansion. The suite of restoration activities included in the 3 action alternatives includes several proposed changes to the HWRP. These alternatives include the addition of the expansion area and the following potential changes to the authorized HWRP.

- Elimination of a separating levee between the BMKV and SLC sites
- Replacement of the barrier levee between BMKV and HAAF, with an access berm for the NSD line
- Extension of the Bay Trail south and north from the City of Novato levee
- Potential use of diesel off-loading and booster pumps for off-loading dredged material
- Potential alternative alignment of dredged-material pipeline directly from the off-loading facility to the BMKV site (Alternatives 1 and 2)
- Change in location of and increase in high transitional marsh on the SLC parcel
- Repositioning of the tidal breach on SLC to BMKV (Alternatives 2 and 3)
- Addition of new NSD pipeline around east side of expanded Pacheco Pond

Table 3-1 provides an overview of the 3 action alternatives; they, and the No-Action Alternative, are described in greater detail in the text that follows. Table 3-2 summarizes the habitats at maturity expected under each of the 3 alternatives. The process through which the alternatives were developed is presented in the U.S. Army Corps of Engineers General Reevaluation Report (GRR).

Table 3-1. BMKV Expansion Alternatives Considered in this SEIR/EIS

	Alternative 1	Revised Alternative 2 (Preferred Alternative)	Alternative 3
Descriptive Name	Dredged Material Placement with Enlarged Pacheco Pond	Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond	Natural Sedimentation with Enlarged Pacheco Pond
Construction Approach	Dredged material placement (13.2 million cubic yards additional for HWRP with expansion)	Dredged material placement (13.8 million cubic yards additional for HWRP with expansion)	Natural sedimentation
Design Elements			
Pacheco Pond Expansion	Yes	Yes	Yes
Outboard Levee Breaches	Novato Creek (BMKV) San Pablo Bay (BMKV) San Pablo Bay (SLC)	Novato Creek (BMKV) San Pablo Bay (BMKV)	San Pablo Bay (BMKV) San Pablo Bay (BMKV)
Habitats	1039 acres tidal wetland 147 acres subtidal and tidal mudflat habitats 40 acres seasonal wetland 10 acres emergent wetland 40 acres open water (pond) 300 acres upland	899 acres tidal wetland 120 acres subtidal and tidal mudflat habitats 277 acres seasonal wetland 12 acres emergent wetland 21 acres open water (pond) 247 acres upland	1,274 acres tidal wetland 197 acres subtidal and tidal mudflat habitats 10 acres emergent wetland 40 acres open water (pond) 55 acres upland

	Alternative 1	Revised Alternative 2 (Preferred Alternative)	Alternative 3
Novato Sanitary District Outfall	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Alt. 1 includes extension of new pipeline around east side of Pacheco Pond, with access road/berm	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Revised Alt. 2 includes access road/berm and extension of new pipeline around east side of expanded Pacheco Pond	Authorized HWRP included relocation of dechlorination plant and retrofit/replacement of existing pipeline. Alt. 3 includes extension of new pipeline around east side of Pacheco Pond, with access road/berm.
New Levees	From enlarged Pacheco Pond to Novato Creek (central crossing levee); along east side of Pacheco Pond	Around east side of expanded Pacheco Pond; along north and south sides of the seasonal wetland; from BMKV/HAAF berm to Novato Creek	Along east side of Pacheco Pond; from enlarged Pacheco Pond to BMK south lagoon and along BMK south lagoon to Novato Creek
Improved Levees	BMK south lagoon	BMK south lagoon and portion of BMKV/HAAF berm; levee west of south lagoon lock	Western portion of BMK south lagoon
Water Management Structures/Pacheco Pond and BMK South Lagoon Connections	Culverts with flapgates at Pacheco Pond; modified BMK lagoon overflow structures; culvert with flapgate in Novato Creek levee	Overflow structure from expanded Pacheco Pond to seasonal wetland; overflow structure from seasonal wetland to tidal wetland area; modified BMK lagoon overflow; and culvert with flapgate to Novato Creek from swale	Culverts with flapgates at Pacheco Pond; pump station near BMK south lagoon lock
Bay Trail, Interpretive Center, and Access Area	Bay Trail along southwest perimeter of HWRP and north from city levee. Bay Trail along west side of Pacheco Pond to Bel Marin Keys Blvd. Spur Option 1A between Pacheco Pond and Hamilton seasonal wetlands, and along central levee to Novato Creek. Interp. Center and access area on property currently owned by the City of Novato west of HWRP seasonal wetland area.	Bay Trail along southwest perimeter of HWRP and north from city levee. Bay Trail between Pacheco Pond and HAAF and between BMKV seasonal wetlands and Pacheco Pond to Bel Marin Keys Blvd around the west side of Headquarters Hill. Interp. Center and access area on Property currently owned by the Cityof Novato west of seasonal wetland area on HWRP.	Bay Trail along southwest perimeter of HWRP and north from city levee. Bay Trail between Pacheco Pond and HAAF seasonal wetlands, along east side of expanded Pacheco Pond to Bel Marin Keys Blvd. Spur Option 3A along new levee south of BMK south lagoon levee to Novato Creek. Interp. Center and access area on northwest side of BMKV.

	Alternative 1	Revised Alternative 2 (Preferred Alternative)	Alternative 3
BMKV Upland Habitat Buffer	Upland habitat buffer area in swale south of BMK south lagoon.	Upland buffer area in swale south of BMK south lagoon.	Upland buffer only in area south of western portion of BMK south lagoon.
PG&E Tower Footings	Jacketed to prevent erosion/corrosion	Same as Alternative 1	Same as Alternative 1

Table 3-2. Estimated Postrestoration Habitat Acreages at BMKV Expansion Site

Alternative	Subtidal	Tidal Mudflat	Low Marsh	Tidal Marsh	High Transitional Marsh	Seasonal Wetland	Freshwater Emergent Wetland	Open Water	Upland	Total
1	90	57	30	849	160	40	10	40	300	1,576
2	72	48	28	792	79	277	12	21	247	1,576
3	130	67	40	1,204	30	0	10	40	55	1,576

Notes:

Upland habitat	=	non-inundated areas; dominated by grassland
Open water habitat	=	areas within expanded Pacheco Pond
Freshwater emergent wetland	=	fringing emergent marsh along expanded Pacheco Pond
Seasonal wetland	=	seasonally-inundated non-tidal areas dominated by hydrophytic vegetation
High transitional marsh	=	areas east of outboard levee inundated by plus tides; above mean higher-high water
Tidal marsh	=	mean high water to mean higher-high water.
Low marsh habitat	=	mean sea level–mean high water
Tidal mudflat habitat	=	mean lower low water–mean sea level
Subtidal	=	aquatic habitat below mean lower low water

The North Marin Water District (NMWD) is considering a plan to extend a water line from Ammo Hill to Bel Marin Keys Boulevard (see figure 1-2 in chapter 1). It is conceivable that the water line could be built during construction of the proposed BMKV expansion. The likely location of the line would be along the existing or new levees constructed along the western side of the BMKV parcel. The NMWD would need to obtain an easement from the Conservancy. Simultaneous construction of the water line and the restoration project is feasible within the designs proposed. Neither constructing the water line nor granting the easement is included as part of the proposed BMKV expansion. However, the design alternatives do not preclude granting the easement or constructing the water line. The Corps and Conservancy will work with the NMWD to examine how the water line planning can be incorporated into the final design of the BMKV expansion. If the proposed water line extension is later determined to result in any additional impacts beyond those analyzed in this document for earthworks construction and habitat restoration, a supplemental environmental compliance document may be necessary. Any additional environmental compliance documentation would be the responsibility of NMWD and not the Corps or Conservancy.

Alternatives Under Consideration

No-Action Alternative

Under the No-Action Alternative, no wetland restoration would take place at the BMKV site and no Bay Trail would be constructed through the BMKV property nor extended further along the perimeter HWRP. Under this alternative, it is assumed that the Corps, Conservancy, or successors in interest would

- allow agriculture to continue on the BMKV site;
- continue to operate and maintain drainage and pumping facilities on the site;
- maintain levees; and
- implement the HWRP, including construction of a barrier levee along the boundary between the HAAF/SLC restoration sites and the BMKV parcel.

Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond

Overview of Alternative 1

Figures 3-1 and 3-2 show Alternative 1 at maturity. Under Alternative 1, tidal (tidal marsh, tidal flat, and subtidal) and nontidal (high-transitional marsh, seasonal wetland, perennial wetland, perennial open water, and upland) habitat types would be restored to the expansion site. Imported dredged material (determined to be suitable wetland cover material based on Dredged Material Management Office [DMMO] requirements) would be used to create upland and seasonal wetland habitats and to create surface elevations suitable to accelerate the establishment of tidal marsh vegetation. Final marsh plain elevations would develop over time through the natural deposition of sediments from San Pablo Bay, supporting the establishment of tidal marsh vegetation. The acreage of each habitat type restored under Alternative 1 is shown in table 3-3 below.

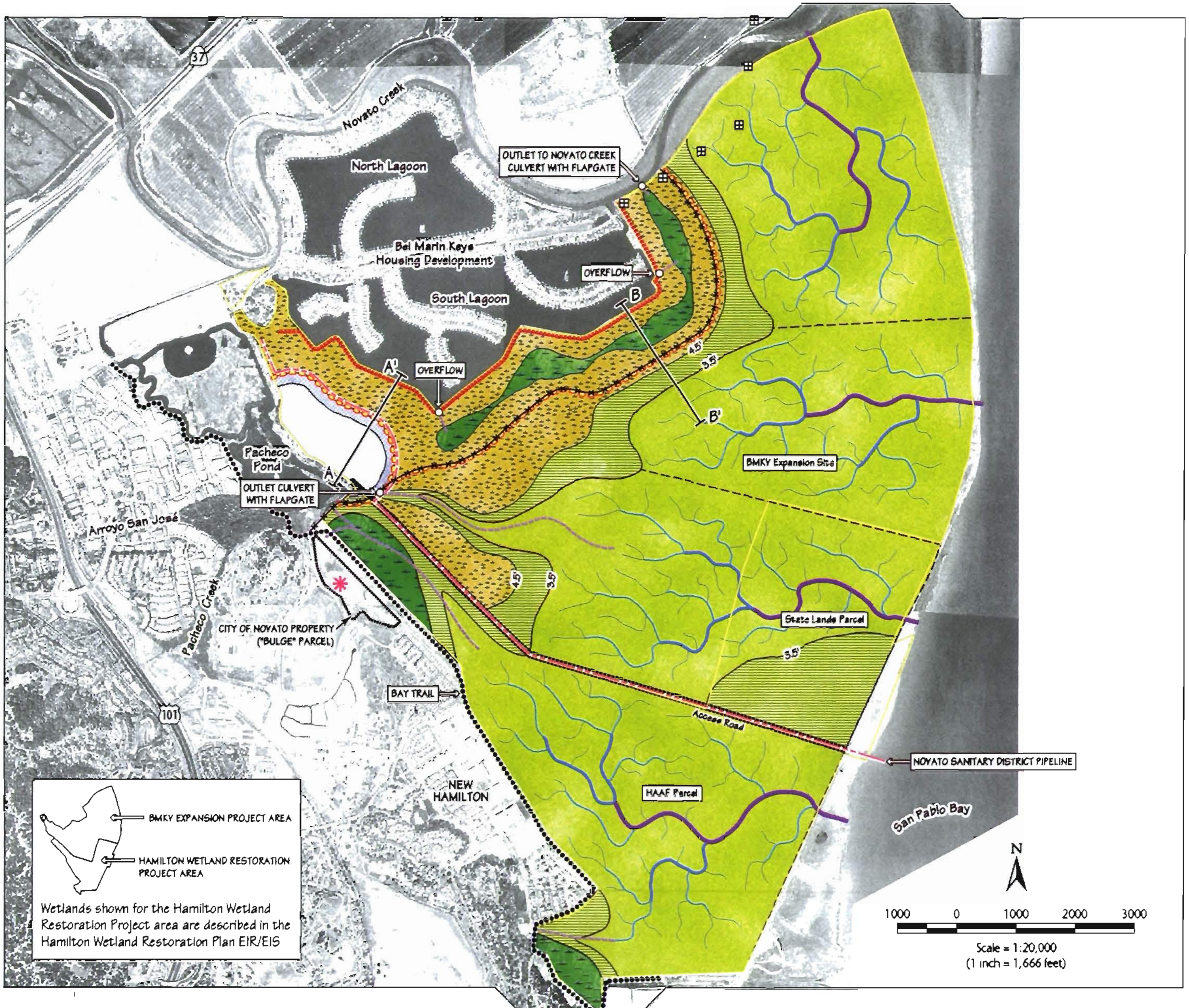


Figure 3-1
Bel Marin Keys Restoration
Alternative 1 at Maturity

Legend

HABITAT TYPES
- Upland Transition
- Freshwater Emergent Wetland
- Seasonal Wetland
- High Transitional Marsh
- Tidal Salt Marsh
- Open Water

CHANNEL ORDER
- Primary channels
- Secondary channels
- Tertiary channels
- Small branches
- Sub-basin Boundary

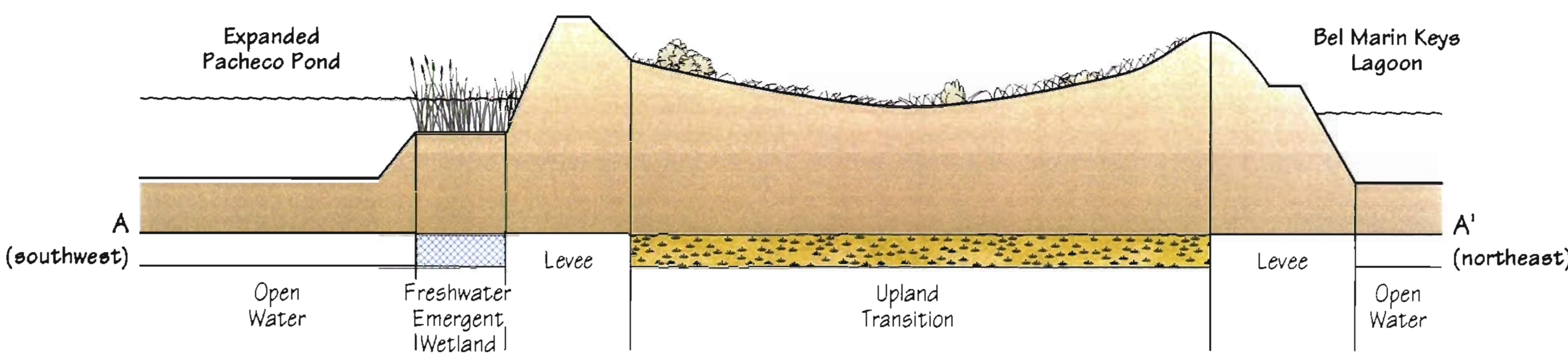
INFRASTRUCTURE
- Overflow Channel and Structure
- New Levee
- Improved Levee
- Existing Levee
- Bay Trail
- Spur Option 1A
- Power Tower
- Novato Sanitary District Pipeline
- Interpretive Center (not part of federal project; access area adjacent, not shown)

Note: Vertical elevations are relevant to NGVD 1929.

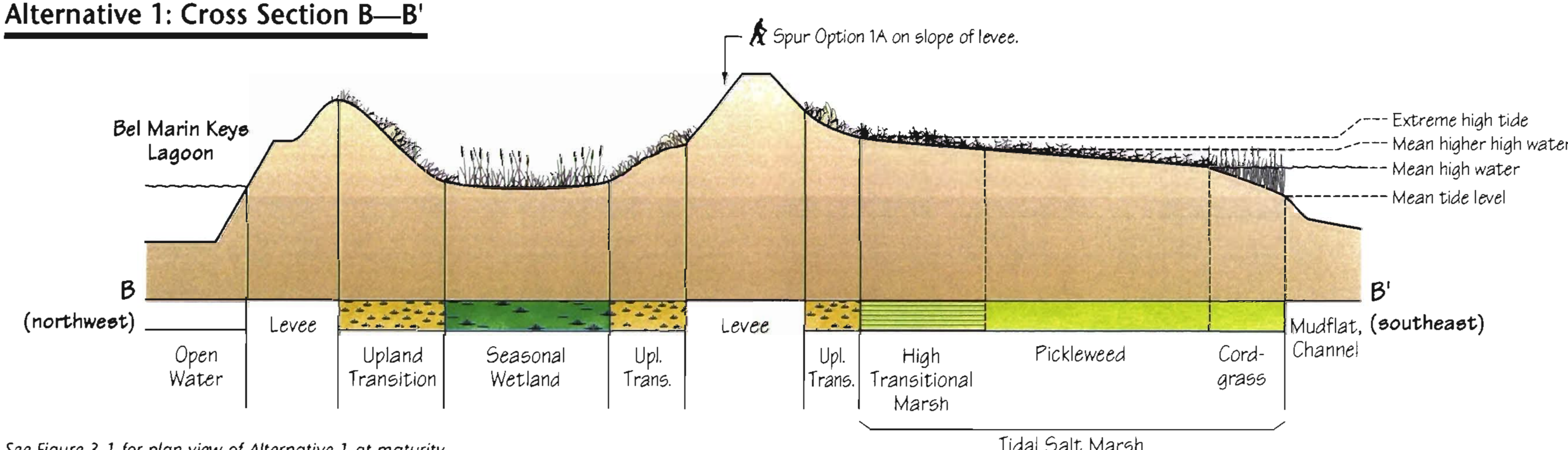
See Figure 3-2 for cross sections A–A' and B–B'.

Jones & Stokes nhc

Alternative 1: Cross Section A—A'



Alternative 1: Cross Section B—B'



See Figure 3-1 for plan view of Alternative 1 at maturity.

Jones & Stokes
nhc northwest hydraulic consultants

Figure 3-2
Schematic Cross Sections of Habitats Restored under Alternative 1

Table 3-3. Summary of Alternative 1: Dredged Material Placement with Enlarged Pacheco Pond

Habitats	1,039 acres tidal wetland 147 acres subtidal and tidal mudflat habitats 40 acres seasonal wetland 40 acres open water (expanded Pacheco Pond) 10 acres emergent marsh 300 acres upland
Outboard Levee Breaches	Novato Creek (BMKV); San Pablo Bay (BMKV); San Pablo Bay (SLC)
Novato Sanitary District Outfall	New pipeline along east side of Pacheco Pond, with access road/berm (4–6' NGVD[1]). Authorized HWRP already includes replacement/retrofit of existing pipeline and relocation of dechlorination plant.
New Levees	From enlarged Pacheco Pond to Novato Creek (central levee 8–12' NGVD). Along east side of expanded Pacheco Pond.
Improved Levees	BMK south lagoon (6–10' NGVD)
Water Management Structures/Pacheco Pond and BMK south lagoon connections	Culverts with flapgates at Pacheco Pond. Culvert with flapgate in Novato Creek levee to drain swale. Modified BMK lagoon overflow structures
Bay Trail, Interpretive Center, and access area	Along southwest perimeter of HWRP and north from city levee and along west side of Pacheco Pond to Bel Marin Keys Blvd. Spur Option 1A between Pacheco Pond and HAAF seasonal wetlands, and along central levee to Novato Creek. Interpretive center and access area northwest of HWRP.

Note:

NGVD stands for National Geodetic Vertical Datum of 1929 which is a fixed reference adopted as a standard geodetic datum for elevations determined by leveling. It was formerly called "Sea Level Datum of 1929" or "mean sea level". Although the datum was derived from the mean sea level at 26 tide stations, it does not necessarily represent local mean sea level at any particular place.

Tidal Wetland Design

In the eastern portion of the site, 3 tidally influenced sub-basins, each approximately 400 acres in size, would be created as cells to facilitate the placement of dredged material and the establishment of tidal marsh vegetation. Dredged material would be placed in each sub-basin to create surface elevations ranging from approximately 2 feet NGVD (1 foot below mean high water [MHW]) along the basin perimeter to approximately 0 feet NGVD near the outboard levee. Additional dredged material would be placed in the southeast corner of the site to create surface elevations (approximately 3.5 feet NGVD) suitable for the establishment of high transitional marsh vegetation. After fill placement activities have been completed, the outboard levees would be breached in 3 locations to restore the hydrologic connections to San Pablo Bay and Novato Creek. The levee along Novato Creek would be lowered to facilitate overflow onto the expansion site from Novato Creek during peak storm events.

The levee along San Pablo Bay would also be lowered to create topographic diversity and facilitate the establishment of mid-high marsh vegetation. Several high points along the levee will be left as high-tide refugia. Final marsh plain elevations would be established via natural deposition of fine-grained sediments from San Pablo Bay and Novato Creek. Final surface elevations in the 3 marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD.

Levees and BMK Lagoon Drainage

A levee with an initial top elevation of 12 feet NGVD would be constructed across the northwestern portion of the expansion site to separate the nontidal and tidal habitats. This initial elevation includes a 4-foot settlement allowance, which would result in a final elevation of 8 feet NGVD. The outboard (east) side of the levee would be constructed with a gentle side slope that would transition from upland to high- to mid-marsh habitat types. The inboard (west) side of the levee would be constructed with a gradual slope from a base elevation of 1 foot NGVD to a crest of 12 feet NGVD. The existing levee along the BMK south lagoon would be improved with an initial top elevation of 10 feet NGVD, which includes a 4-foot settlement allowance, resulting in a final top elevation of 6 feet NGVD (see figure 3-12 at the end of this section). This alternative would also include an overflow structure or structures would be installed to convey overflow from the lagoon into the swale area. Overflow from the lagoon and seasonal precipitation would support the establishment of seasonal wetland habitat in the swale located between the 2 levees. Plant species composition in this area would vary according to salinity, inundation frequency, and duration; however vegetation would likely consist of emergent wetland vegetation (e.g., bulrushes, cattails, rushes), and grasses and forbs. Conceptual levee designs are shown in figure 3-12 after page 3-38 in this section.

Nontidal Habitat Design and Pacheco Pond Connection

In the northwestern portion of the expansion site, approximately 50 acres of perennial open water and wetland habitat would be created by enlarging an existing pond (Pacheco Pond). The levee that now separates the expansion site from Pacheco Pond would be breached in several locations to provide a larger contiguous area of open-water habitat. The bottom elevation of Pacheco Pond would remain at the existing elevation of -3 feet, and the pond would continued to be managed to maintain a surface water level of approximately 1.5 feet following enlargement of the pond. Sections of the levee would be left in place to provide roosting and nesting habitat for shorebirds. A bench would be constructed along the inboard perimeter of the new pond levee to promote the establishment of freshwater emergent vegetation. A culvert structure would be installed in the new pond levee to allow the release of overflow waters from the pond into the tidal marsh basin. A significant portion of existing Pacheco Pond storm runoff may be directed through the tidal marsh basin.

The salinity of the water in the channel flowing through the tidal marsh basin would vary, depending on the outflow from Pacheco Pond and the extent of tidal inundation. As water is released from Pacheco Pond following large wet season storm events, salinities within the channel would range from freshwater values near the overflow to brackish and marine levels as water flows into the marsh basin. During extreme high tides, the channel would be inundated by tidal flow and salinity would increase to near marine levels. The freshwater pond environment would not be affected during these periods because the flapgate would prevent tidal flows from entering the pond. During the summer months and dry times of the year, the salinity of water in the channel would be comparable to that in San Pablo Bay.

Under this alternative, Pacheco Pond would have 2 outlets: the existing outlet to Novato Creek via the outlet channel, and a new outlet to the tidal marsh restoration area. DFG and the Marin County Flood Control and Water Conservation District (MCFCWCD) have an existing agreement to manage Pacheco Pond for the dual purposes of flood control and wildlife. The BMKV expansion would include development of a new water management plan for Pacheco Pond, which the Conservancy or successors, DFG, and MCFCWCD would jointly implement to continue manage flood control and wildlife.

Novato Sanitary District Outfall

The authorized HWRP already includes the relocation of the NSD dechlorination plant and the relocation/retrofit of the existing NSD pipeline. Alternative 1 would include the installation of a new sanitary outfall pipeline along the eastern side of the expanded Pacheco Pond and construction of an access road/berm. The existing pipeline would be replaced or retrofitted as part of the HWRP because of potential differential settling and leakage (U.S. Army Corps of Engineers 2001b). If a new pipeline is placed, it would be installed slightly below the grade of the existing pipeline; the existing pipeline would be abandoned in place to provide protection from potential scour associated with the formation of tidal channels. The NSD pipeline would be located along a new alignment around the east side of the expanded Pacheco Pond. The pipeline would be installed at a depth below the invert of the outlet structure from Pacheco Pond to the tidal wetland restoration area.

NSD would access the pipeline by existing or new levees leading to an improved berm along the existing alignment (at the property line separating BMKV from HAAF). The top of the berm would be built to between 4 and 6 feet NGVD. If the top of the berm were built to 4 feet NGVD, it would be 0.5 foot above mean higher high water (MHHW), which is suitable for high marsh community establishment but not for upland conditions. At this elevation, equipment could only use the berm for emergency situations or scheduled or permitted repair of leaks in the pipeline; the access road would not be an "all-weather" road.

If the top of the berm were built to approximately 6 feet NGVD, it would be 2.5 feet above MHHW, which is suitable for upland conditions. The berm could provide access for regular maintenance or inspections, in addition to emergency situations and scheduled and permitted repair of leaks in the pipeline.

The purpose of analyzing 2 elevations for the access road is to evaluate the tradeoffs between creating upland corridors for predators (such as red fox) and differing levels of access for NSD.

As part of the authorized HWRP, the existing NSD dechlorination plant would be relocated to NSD's Ignacio Treatment Plant, Novato Treatment Plant, or another suitable location. Relocating the dechlorination plant would avoid the need to provide an alternative power supply to the plant and would make the plant more easily accessible to NSD personnel for operation and maintenance.

Bay Trail, Interpretive Center, and Access Area

Alternative 1 would also include construction of public access facilities. The existing HWRP routes a Bay Trail along the City of Novato levee, which has an existing trail, along the west side of the HWRP restoration area.

Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field and then proceed along the southwestern perimeter of the HWRP to a point approximately 700 feet from the existing outboard marsh. The trail would follow either the existing road or a new levee constructed as part of the HWRP, until meeting the existing perimeter levee. The trail would then turn northward, and then eastward to follow the improved levee that would be built in the location of the existing perimeter levee (routing of the Bay Trail at Hamilton is shown on figure 3-1 and on figure 4-10 in the *Biological Resources* section in chapter 4). The City of Novato has adopted a plan to connect this portion of the trail to an interim trail, which would traverse the Las Gallinas Valley Sanitary District property to the south, and then connect to the Bay Trail further south. This is not part of the expansion of the HWRP.

Also under this alternative, the Bay Trail would be extended northward along the west side of Pacheco Pond to Bel Marin Keys Boulevard. The trail would proceed north from the City of Novato levee along the western edge of the HWRP restoration area, proceed around the base of Ammo Hill on existing dirt roads on City of Novato-owned land, cross the confluence of Pacheco and San Jose Creeks, follow the existing MCFCWCD service road, and then connect to Bel Marin Keys Boulevard by boardwalk and bridge (approximate length 200 feet). Crossing the confluence would require the installation of several additional bridges (each approximately 75 feet long) and a number of sections of boardwalk. The total approximate length of boardwalk sections would be about 1,800 feet.

A review of parcel maps for this area indicates that the trail would cross federal land (on HAAF), city-owned land (northwest of HAAF near Ammo Hill), and MCFCWCD-owned land. Under this alternative, the Corps and Conservancy would construct the trail on state and federal land, the Conservancy would construct the trail on MCFCWCD land (if MCFCWCD granted an easement), and the City of Novato would construct the portion on its land. The land for this proposed trail segment around the west side of Pacheco Pond is not owned by the Conservancy. Coordination and agreement with MCFCWCD would be required to acquire easements and/or additional property to facilitate construction.

Spur Option 1A would include a spur trail eastward from the Bay Trail to Novato Creek. It would cross the levee between Pacheco Pond and the HWRP, and proceed along the proposed levee that separates the upland buffer/swale area from the restored tidal wetlands. This spur would terminate at Novato Creek, where a gate would be installed to prevent trail users from entering the BMK residential area.

The final site-specific design of the new Bay Trail has not been completed, but it may include some of the following components (City of Novato and the California State Coastal Conservancy 2001).

- Locating the trail on the mid-slope of levees to minimize visual disruption effecting sensitive wildlife, where feasible.
- Designing the trail to ensure a buffer between the trail and sensitive habitat areas, and providing overlooks or vista points offering views of buffer zones and adjacent habitat areas
- Installing barriers (such as fencing) or buffers (such as vegetation), as appropriate, to prevent intrusion by humans and pets
- Grading a topographic separation or constructing trail segments at low elevations relative to adjacent residential areas to provide privacy
- Installing a gated entry to exclude motorized vehicles

The Conservancy, Corps, or successors in interest would develop the final design for any proposed Bay Trail routes or spur trail options in coordination with BCDC, DFG, USFWS, the County of Marin, the City of Novato, and the Bay Trail project. In addition, the Conservancy, Corps, or successors in interest would develop a trail management plan in cooperation with these same agencies. This management plan would take into account the results of the latest research in the San Francisco Bay Area on wildlife/access interactions. The plan would evaluate and/or incorporate the following elements.

- Restriction of motorized vehicle access
- Restriction of dog access
- Restriction of fishing and/or wildlife feeding
- Seasonal/periodic closures during sensitive wildlife seasons

- Timing of trail maintenance
- Annual monitoring of access/wildlife interactions

Additional public access facilities proposed under Alternative 1 include an interpretive center located southeast of Ammo Hill and west of the HAAF seasonal wetland restoration area. This property is currently owned by the City of Novato and is referred to as the "bulge" parcel. The interpretive center would be located along the road designated as the HWRP wetland restoration access road, and is conceptually envisioned as an approximately 1000-square-foot building housing exhibits that provide information about the wetland restoration projects and the local flora and fauna. The interpretive center would serve as a trailhead and would be connected to the proposed Bay Trail routes by new trails routed along existing dirt roads.

Since the interpretive center will be placed on lands that are not required for federal project purposes, and since Corps policy greatly limits expenditures for educational facilities, the interpretive center will not be a project feature to be paid for or constructed by the federal government. The land required for the interpretive center is outside the Federal project. However, the project design has accommodated the interpretive center construction, which would be carried out by others. The federal government will be able to share the expenses of some recreation features including a parking area (approximately 10-20 spaces), restrooms, and information kiosks. These features would take up about 2 acres and are referred to collectively in this document as the "access area." Only land required for these approved features can be cost-shared by the Federal government.

Habitat Benefits

Alternative 1 would provide 1,039 acres of tidal wetland; 147 acres of other tidal habitats; 40 acres of seasonal wetland; 40 acres of open water (expanded Pacheco Pond); 10 acres of emergent marsh, and 300 acres of upland. Restoration of the proposed habitats would benefit numerous special-status and common wildlife species. The restoration of tidal salt marsh and associated aquatic habitats is expected to contribute to the recovery of populations of several wetland-dependent special-status species by substantially increasing the amount of viable habitat available for these species in San Pablo Bay.

Subtidal Aquatic Habitat. Many species of waterfowl and diving birds use this habitat for feeding on benthic organisms which can be found in the sandy, muddy bottom. Bay fish species also utilize this area.

Intertidal Aquatic Habitat. Intertidal aquatic habitat comprises intertidal mud flats and coastal salt marsh. Mudflats are highly productive and support large populations of benthic organisms, including aquatic worms, crustaceans, and mollusks and are important elements of the estuarine food web. Mudflats also provide important foraging areas for migrant and wintering shorebirds, wading

birds, and gulls. Benthic organisms use this habitat in the same way they use intertidal mudflats.

Coastal Salt Marsh. Tidal coastal salt marsh provides ideal foraging conditions for rails, egrets, herons, waterfowl, and shorebirds, among others. The salt marsh community provides nutrients and organic matter to the mudflats and open water of the Bay. These, in turn, are important habitats for a variety of waterfowl, shorebirds, and other water birds. Coastal salt marsh is also used as direct cover and sources of food by rearing juvenile and adult fish, such as longfin smelt, Chinook salmon, and steelhead. Sensitive species like the California clapper rail, salt marsh harvest mouse, salt marsh common yellowthroat, and San Pablo song sparrow are dependent on coastal salt marsh.

Seasonal and Emergent Wetlands. Seasonal and emergent wetlands potentially provide high-tide refugia for California clapper rail, California black rail, and other species that use tidal coastal salt marshes. They provide seasonal foraging and resting habitat for migratory shorebirds, waterfowl, and other water birds. They also provide foraging habitat for raptors, herons, egrets, blackbirds, raccoons, striped skunks, and aquatic garter snakes. Emergent marsh habitat also provides nesting, foraging, and escape cover for various songbirds and wading birds.

Open Water. Water birds expected to use open water include waterfowl, grebes, loons, cormorants, rails, pelicans, coots, moorhens, terns, gulls, herons, egrets, shorebirds, and blackbirds. The open water (i.e., Pacheco Pond) would also be expected to support smelt and bullhead, among other fish species.

Upland/Grassland. Annual grassland provides habitat for various wildlife species. Representative wildlife species that would be expected to use grasslands at the expansion site are the turkey vulture, white-tailed kite, northern harrier, red-tailed hawk, golden eagle, American kestrel, short-eared owl, savannah sparrow, western meadowlark, and Brewer's blackbird. In addition, these upland areas can also be used as high-tide refugia by birds utilizing tidally-inundated areas.

Construction Approach, Alternative 1

The following provides a detailed description of construction activities that would be implemented under Alternative 1 to restore salt marsh, perennial open water and wetlands, seasonal wetlands, and uplands at the BMKV site. Construction activities to restore habitats on the site would be implemented in 3 phases.

- Phase 1 – Site Preparation
- Phase 2 – Dredged Material Placement
- Phase 3 – Earthwork, Revegetation, and Tidal Connection

Site preparation includes the construction activities necessary to prepare the site for dredged material placement (e.g., removal of existing infrastructure, construction of levees) and initial excavation of the primary slough channel. *Dredged material placement* consists of pumping and placing dredged material, decanting water (resulting from the settling of slurry material), and, if required, treating the decanted water prior to discharge into San Pablo Bay. *Earthwork, revegetation, and tidal connection* include activities such as seeding/planting nontidal areas, and final earthwork activities (e.g., levee grading, breaching). Figure 3-3 illustrates the construction effort for Alternative 1.

Phase 1 – Site Preparation

Create Staging Area and Site Access

A staging area approximately 20 to 30 acres in size would be created in the southern portion of the site, midway between Pacheco Pond and the SLC parcel, to provide storage for salvaged soils and sediments and for equipment, fuel, and supplies. Areas used for staging and site access would be cleared and graded. Heavy equipment such as bulldozers, scrapers, and graders would be used to construct the staging area and any required site-access improvements.

Modify and Remove Existing Infrastructure

The expansion site supports a variety of site-specific (farm buildings, drainage pumps, ditches, pipelines, and levees) and regional (electric transmission line towers, sanitary sewer outfall line) infrastructure that would be modified or removed prior to the onset of restoration activities. The electric transmission line towers located onsite would be jacketed with concrete to minimize corrosion associated with tidal inundation. Utility service would not be interrupted during this activity. A new outfall pipeline would be installed along the levee (the existing alignment) that separates the expansion site from the adjacent HAAF parcel. The new pipeline would be installed below the grade of the existing pipeline; the existing pipeline would be abandoned in place to provide protection from potential scour associated with the formation of tidal channels. Equipment, such as bulldozers, excavators, loaders, cranes, cement mixers, and dump trucks, would be used to modify and/or demolish existing infrastructure.

Excavate and Salvage Topsoil

Dredged material would be placed in areas designated for nontidal habitat under this alternative to help establish target elevations. The final foot of cover material for the nontidal habitat areas would be either dredged material or salvaged onsite topsoil. Use of dredged material would be as described below under *Dredged Material Placement*. Using dredged material as cover would result in saline soils that could inhibit nontidal vegetation establishment until freshwater flows and/or precipitation over time resulted in an environment more favorable to nontidal vegetation. Use of onsite topsoil as cover would result in soils that are initially more favorable to nontidal vegetation, although existing onsite topsoil could contain seed from non-native species. Both approaches are considered in the conceptual design.

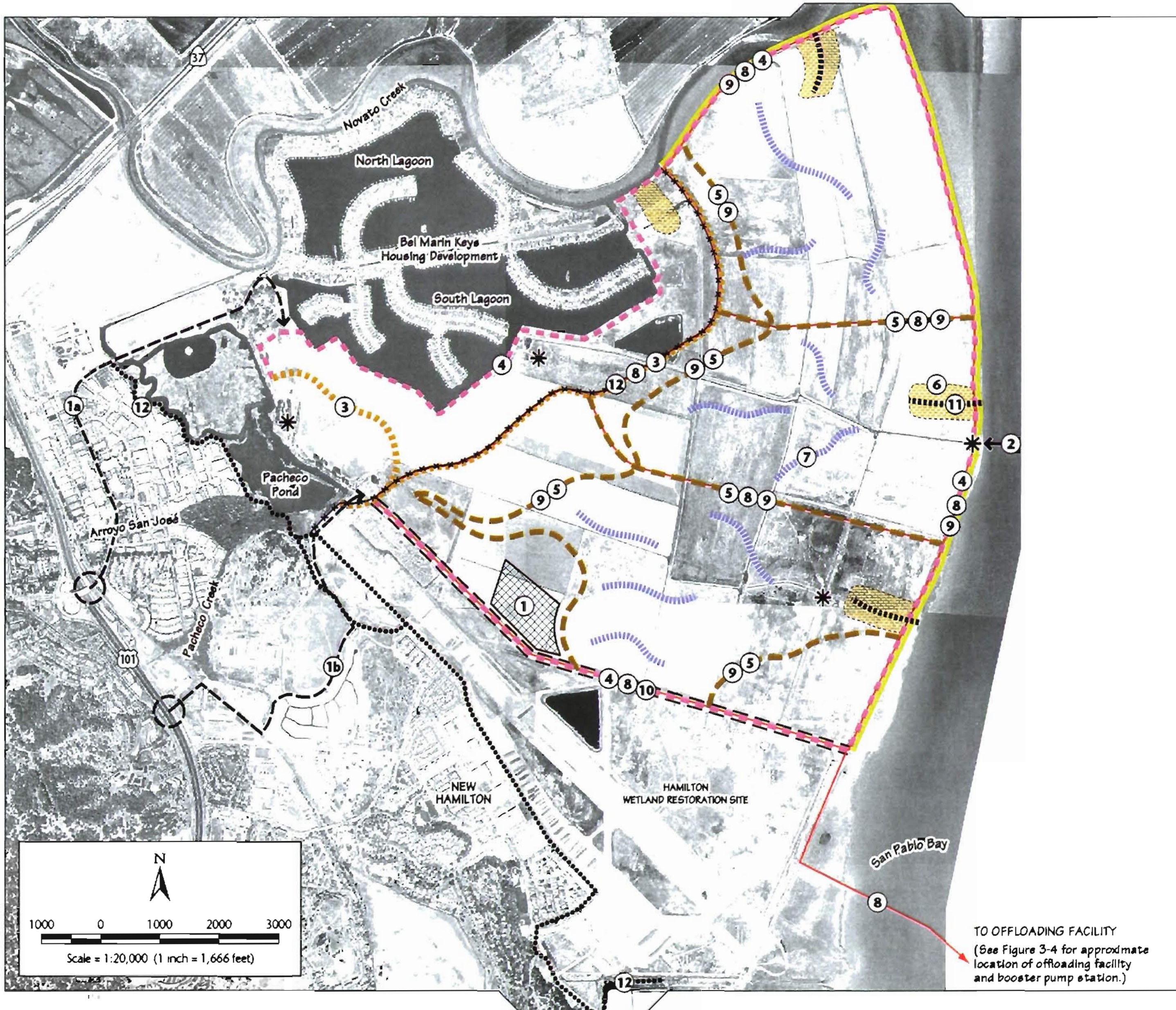


Figure 3-3
Construction Approach for Bel Marin Keys Alternative 1

Phase 1: Site Preparation

1. Create staging area ( ) and site access ( ):
   - 1a = Bel Marin Keys Boulevard;
   - 1b = Hamilton Wetland Restoration Project.
2. Demolish existing infrastructure (e.g., pump facility and other structures)
3. Construct new levees.
4. Construct/improve perimeter levees/berms.
5. Construct phase levees/berms.
6. Construct water quality detention ponds and excavate pilot channels.
7. Construct internal peninsulas.
8. Construct dredged material placement infrastructure:
   - delivery pipe,
   - distribution pipes along levees, and
   - multiple outlets.

Phase 2: Dredged Material Placement
(Note: this phase is not shown in the figure.)

1. Pump dredged material.
2. Decant water.
3. Treat decanted water and discharge.

Phase 3: Earthwork, Revegetation, and Tidal Connection

9. Lower phase levees ( ) and outboard levees ( ).
10. Construct NSD sanitary line access road.
11. Excavate connecting channels and breaches.
12. Construct Bay Trail ( ) and potentially Spur Option 1A ( )

NOTE: Locations of internal peninsulas and other features shown in this figure are approximate. Exact locations will be determined during final design

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In addition to potentially being used as final seasonal wetland cover, salvaged onsite soil would also be used for construction of earthworks such as levees and berms.

Approximately the upper 1 to 2 feet of existing site soils and sediments would be excavated from designated areas for later application in nontidal habitat areas during Phase 3 or use in earthworks. The upper 3 inches of the onsite material would be removed and stockpiled separately for use as base material in earthworks to limit the germination of existing non-native seed stock and the proliferation of non-target plant species. The lower portion of onsite material would be salvaged and stockpiled separately within the staging area for use as nontidal habitat cover and/or in earthworks. Materials would be excavated using excavators, scrapers, and bulldozers, and transported to the stockpile area using dump trucks.

Construct Levees

A variety of levees would be constructed on the expansion site to facilitate creation of habitat features and placement of dredged material, and to provide appropriate levels of flood protection for adjacent landowners. Design parameters and functions would vary by levee type. However, site preparation techniques and construction activities would typically be consistent for all levee types.

Prior to levee construction, the footprint of the levee would be cleared, and the ground surface would be excavated to a suitable depth and compacted. Excavated material would be stockpiled onsite for future reapplication (see *Excavate and Salvage Topsoil* above). The levees would be constructed using suitable excavated material from the site or imported fill material. Geotextile materials may be used to enhance the stability of the levee foundations. Levee construction would involve a variety of heavy equipment, such as excavators, loaders, backhoes, track-mounted cranes, and bulldozers. Equipment such as dump trucks, bottom-dump trucks, or scrapers would be used to transport imported or borrow material to the levee construction areas.

New and Improved Levees/Berms

Approximately 37,500 linear feet of existing levees/berms along the perimeter of the site would be improved to facilitate the placement of dredged material. Additional levees, approximately 13,000 feet in length, would be constructed across the western portion of the site to create habitat features (e.g., open-water and freshwater wetland habitats) and to provide appropriate levels of flood protection for adjacent landowners. Levees would typically have a top width of 12–16 feet and side slopes appropriate for site conditions (at least 3:1 [horizontal:vertical] side slopes). The levees would be used as access roads and would be engineered to support vehicle loads and to prevent excessive seepage. Turnaround areas would generally be constructed every 2,000 feet. The levees would also be used to support the delivery pipeline for dredged materials. Equipment used for construction and/or improvement of perimeter levees may include bulldozers, excavators, scrapers, and graders, as well as dump trucks for delivery of suitable fill and/or road-base materials.

The berm along the southern perimeter of the site (between BMKV and HAAF) would be constructed to between 4 and 6 feet NGVD under this alternative.

Phase Levees

Prior to transporting and placing dredged material, a series of internal levees (approximately 30,400 linear feet) would be constructed within the expansion restoration site to facilitate phasing (i.e. construction of smaller portions of the site in sequence rather than the entire site at once). The site would be divided into 3 subunits based on drainage basin size and configuration. Phase levees would typically have a top width of between 12 feet and 16 feet and side slopes appropriate for site conditions (at least 3:1). Levee elevations would vary, depending on existing topography and the desired final marsh plain elevation. The levees could be used as access roads and would be engineered to support vehicle loads. Turnaround areas would generally be constructed every 2,000 feet. The levees could also be used to support the delivery pipeline for dredged materials.

Interior Peninsulas

A series of berms and interior peninsulas (approximately 15,800 linear feet) would be constructed within the marsh basins to: facilitate placement of dredged material, maximize dredged material residence time, and promote sediment settling; reduce resuspension of sediments due to wind/wave mixing; and decrease wave fetch, reducing wave erosion of perimeter and containment levees. Berms would be constructed along basin divides based on the proposed drainage channel subdivide networks. The berms would be constructed with gently sloping side slopes and a maximum elevation between MHW and MHHW. The berms and interior peninsulas would be constructed to gradually erode over time to create topographic diversity within the marsh basins and promote development of mid-and high-marsh vegetation.

Construct Water Quality Detention Ponds

The expansion site would be subdivided into marsh drainage basins approximately 400 acres in size (corresponding to the phase units described previously). A pilot channel approximately 150 feet wide and 800 feet long would be excavated in each marsh basin. Excavated materials would be used to construct berms around the pilot channel to form water quality detention ponds. Each pilot channel would function as a primary drainage route for water decanted from the marsh basin. Decanted water would flow into the water quality detention pond and would be discharged through gravity flow or by pumping from the pilot channel into San Pablo Bay or Novato Creek. Depending on water quality parameters, decanted water would either be discharged directly into San Pablo Bay or Novato Creek, or treated prior to discharge. Traditional earthwork equipment, including excavators, backhoes, bulldozers, and scrapers would be used to construct the detention ponds. If the site is too wet to support traditional equipment, equipment such as track-mounted excavators or draglines might be used instead.

Construct Dredged Material–Related Infrastructure

Construction of the off-loader facility and primary pipeline was studied in the 1998 EIR/EIS for the HWRP. However, the potential use of pile-driving and diesel pumps is analyzed in this document because it was not studied in the prior EIR/EIS. Also, placement of the secondary distribution pipelines on BMKV is studied in this document because it was not studied in the prior EIR/EIS.

Material Off-loading Facility

Transport scows and hopper dredges would be used to move material from areas where dredging is taking place to a designated off-loading facility in San Pablo Bay. The off-loading facility would be located approximately 30,000 feet from the expansion restoration site at approximately the –24 to –28 foot mean lower low water (MLLW) contour to enable large scows and transports (5,000 cubic yard capacity) to moor and off-load. Dredged material would be removed from the barges at the off-loading facility and pumped to the expansion site. Water would be added to the dredged material via an auxiliary feedwater pump to create a slurry consisting of approximately 20% dredged material and 80% water by volume. The pump would be powered by diesel fuel or electricity. If required, electrical power would be provided by a submerged high voltage power cable from the expansion site or from other existing power lines in adjacent areas. The off-loader platform may be either pile-mounted or floating. If pile-mounted, approximately 24 piles (each 36 inches in diameter) would be needed for the off-loader platforms.

Primary Delivery Pipeline

An 18-inch or larger pipeline would be used to transport slurry from the off-loading facilities to the expansion site. The pipeline may be submerged and anchored to reduce hazards to navigation and vulnerability to wind and wave action. As indicated in figure 3-4, the final routing of the pipeline would be determined in final design, but it might be routed to the HAAF or BMKV site.

Booster Pump Facility

One or more booster pump facilities consisting of a platform and booster pumps would be installed in designated locations along the primary delivery pipeline to enhance pumping capacity and facilitate delivery of the dredged material slurry to the expansion restoration site. Depending on specific location and other factors such as wind and wave action, the platforms may be either pile-mounted or floating. A booster pump might also be located along the shore segment of the pipeline. The booster pumps would be powered by diesel or electricity. If required, electrical power would be provided by a submerged high voltage power cable from the expansion site or from other existing power lines in adjacent areas. If pile-mounted, approximately 4 to 8 piles (each 36 inches in diameter) would be needed for the booster platform.

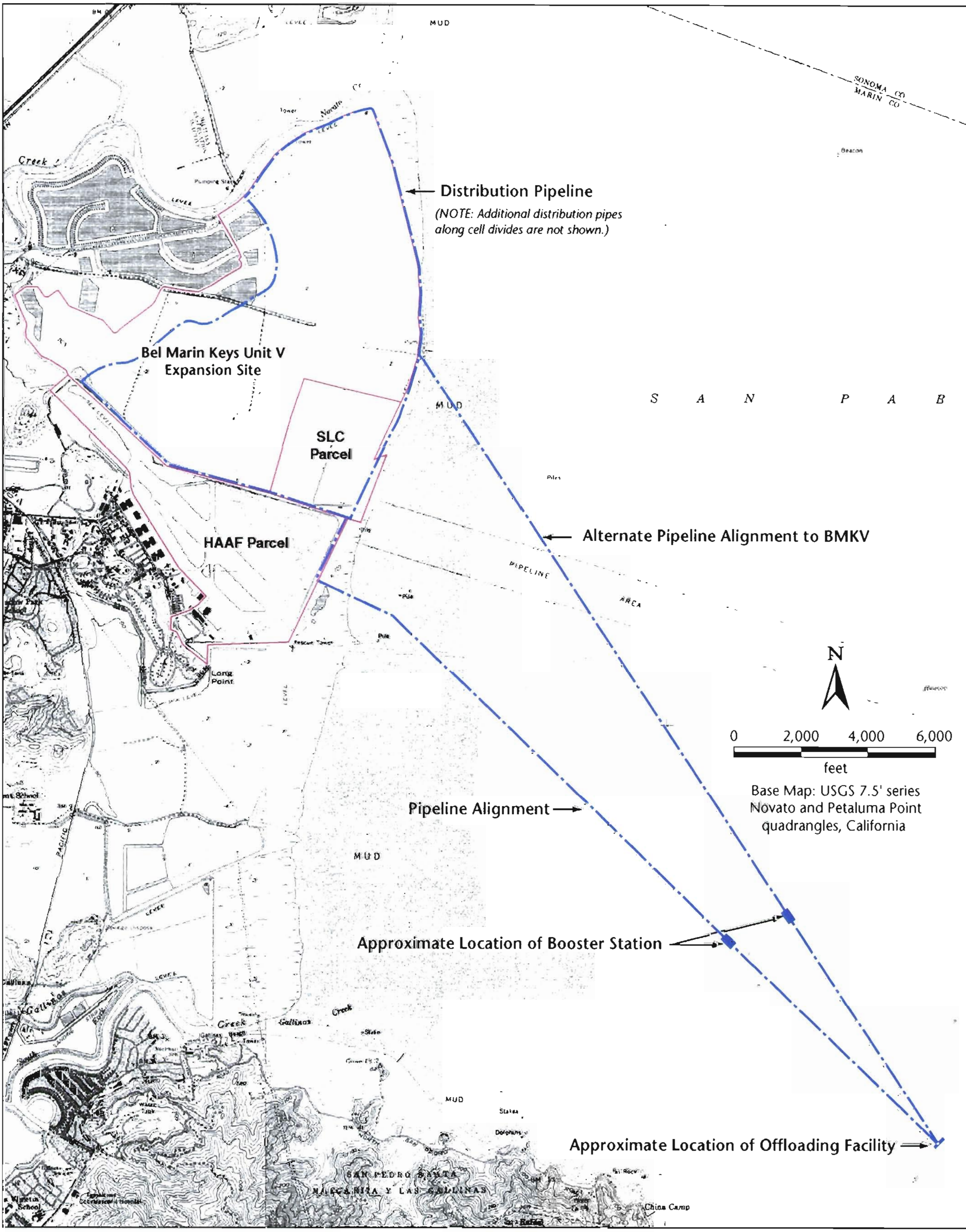

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Figure 3-4
Approximate Location of Offloading Facility

Secondary Distribution Pipelines

A series of secondary pipelines would be used to convey the slurry from the primary pipeline to selected marsh basins. The secondary distribution pipelines would be placed on the perimeter and phase levees. If necessary, additional mobile pumps would be placed at locations along the secondary distribution pipeline to keep the slurry moving through the pipeline. Discharge points would be provided at regular intervals along the secondary pipelines to ensure even distribution of the slurry within the marsh basins.

Phase 2 – Dredged Material Placement

Pump Dredged Material

The dredged material slurry would be pumped from the off-loading facility through the primary and secondary pipelines and delivered to the marsh basins. Over a relatively short time, the sediment in the slurry would separate and settle to the bottom of the marsh basins. Sand and other coarser material would settle first, followed by the finer-grained silts and clays. Because the coarser materials may tend to mound near the slurry inlet, it may be necessary to reposition the inlet occasionally to ensure even distribution of material.

Approximately 13,200,000 cubic yards of additional dredged material (beyond that already included in the authorized HWRP) would be imported to the expansion site for creation of tidal and nontidal habitats. Dredged material may originate from many sources, including the Port of Oakland 50-foot Deepening Project, Corps of Engineers operations and maintenance dredging program, and other non-federal dredging projects. Only material determined to be suitable wetland cover material by the DMMO would be accepted for use at the expansion site. Through a review of potential dredging, the Corps has estimated that adequate dredged material supplies are available for the HWRP/BMKV expansion project. The Corps and Conservancy are willing to accept dredged materials from the Bel Marin Keys Community Services District (BMK CSD) (from lagoon and Novato Creek dredging events) and from the MCFCWCD (from Novato Creek dredging events) if they are determined to be suitable wetland cover material by the DMMO, their reuse is cost-effective to the project and the timing and other parameters of the dredged material's availability are consistent with the project implementation process.

Placement and draining operations would continue until the desired surface elevations (0 feet to 2 feet NGVD) have been reached in each marsh basin. Final elevations in the tidal marsh basins would be established by natural sedimentation and erosion processes once tidal action has been restored to the expansion restoration sites. Soils and sediments salvaged onsite would be used to create final surface elevations in areas of nontidal habitat.

Treat Decanted Water and Discharge

As solids settle from the slurry, clarified water would be decanted and discharged to a water quality detention pond at the mouths of the main channels (location to be determined). Before it is discharged to San Pablo Bay, the water would be tested to ensure that it meets or exceeds the BMKV expansion waste discharge requirements. Depending on the results of the tests, decant water may be treated before discharge, or it may be discharged directly into the Bay.

Phase 3 – Earthwork, Revegetation, and Tidal Connection

Grade Phase Levees to Finished Grade

After dredged materials are placed and dewatered, the phase levees would be graded down to an elevation between MHW and MHHW to create topographic diversity, promote establishment of mid- to high-marsh vegetation, and provide refugia for wildlife species. Portions of the existing outboard levee would be left in place to provide high-tide refugia for marsh species. Grading would involve a variety of heavy equipment, such as excavators, backhoes, track-mounted cranes, bulldozers, and haul trucks.

Create Habitats through Use of Salvaged Topsoil

If salvaged topsoil were used for final cover in nontidal habitat areas, site soils and sediments excavated and salvaged during Phase 1 would be placed in the seasonal wetland and upland habitat areas to facilitate the establishment of native vegetation and prevent the development of acid sulfate conditions. Haul trucks, bulldozers, and compactors would be used to transport and place salvaged materials. As discussed above, dredged material may also be used for habitat creation.

Seed/Plant Nontidal Habitat Areas

As necessary, areas of nontidal habitat would be seeded and/or planted with native vegetation.

Install Water Management Structures

During the final phases of construction, a number of flow control structures (e.g., culverts, weirs) would be installed to facilitate future water management activities. An overflow structure (roughly equivalent capacity to six 4-foot by 4-foot box culverts) would be installed in the new Pacheco Pond levee to allow the release of overflow waters from the pond into the tidal marsh basin. The existing overflow from the BMK lagoon in the northern portion of the site would be modified by adding culverts to facilitate overflow into the constructed seasonal wetland swale during storm events. An additional culvert with a flapgate, approximately 48 inches in width, would be installed in the existing Novato Creek levee to allow the swale to drain into Novato Creek.

Excavate Connecting Channel and Breach Levee

Upon completion of dredged material placement activities, the water quality detention basins would be filled to the final placement grade, pilot channels approximately 150 feet wide and 800 feet long would be excavated in each marsh basin, and the perimeter levee would be breached to restore the tidal connection with San Pablo Bay and Novato Creek. Upon completion of dredged material placement activities, the perimeter levees would be breached and pilot channels would be excavated in designated locations to restore tidal connections to San Pablo Bay and Novato Creek. On either side of the levee breaches, the outboard levee would be lowered to an elevation between MHW and MHHW to create topographic diversity, promote establishment of mid- to high-marsh vegetation, and provide refugia for wildlife species. Additionally, the levee along Novato Creek would be lowered to approximately MHW to facilitate overflow onto the expansion site from Novato Creek during peak storm events. Levee breaching and grading and channel excavation would involve a variety of heavy equipment, including track-, mat-, or pad-mounted excavators; backhoes; bulldozers; dump trucks; draglines; and/or a suction dredge.

Construction Timing, Alternative 1

Under Alternative 1, site construction is expected to last approximately 13 to 15 years; anticipated durations of the 3 construction phases are as follows.

- Site preparation – 2 years
- Dredged material placement – 10 years (includes placement and dewatering and consolidation for HAAF, SLC, and BMKV)
- Earthwork and tidal connection – 1 year

As noted above, this alternative includes three tidal sub-basins and other habitat areas such as the swale area, separated by either temporary or permanent levees. Restoration activities could be conducted based on sub-basin boundaries and/or habitat types, to allow for sequential creation of habitat. Fill could be placed either sequentially or concurrently in different basins and/or habitat types. As one example of the sequential approach, dredged material placement in one of the tidal cells would take about 4 years. Upon completion of dredged material placement, breaching of this tidal cell could take place prior to filling of the other cells. For the first tidal cell, construction time to tidal breach could be around 7 years in a sequential approach.

The Alternative 1 schedule is dependent in part upon completion of the FUDS remedial activities on the SLC parcel on the authorized HWRP site. Because there is no separating levee between BMKV and the SLC parcel in this alternative, breaching into the southern cell could not be completed until the FUDS remedial activities have been completed and the placement of additional dredged material to create high tidal marsh has been completed.

Revised Alternative 2 – Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond

Revised Alternative 2 – Preferred Alternative

During the review of the Draft SEIR/EIS, the Corps and Conservancy made several design changes to Alternative 2 as a result of public and agency comment on the document, design requirements, and environmental factors. Subsequently, the Corps and Conservancy selected the Revised Alternative 2 as the preferred alternative. The following are the revisions made to the design of Alternative 2, and a description of these changes follows below:

- Expansion of the swale south of the BMK south lagoon from 230 acres to 388 acres (including 247 acres of upland and 141 acres of seasonal wetland);
- Addition of a 21-acre expansion of Pacheco Pond with an adjacent 12-acre emergent marsh (33-acre expansion);
- Construction elevation of south lagoon levee reduced from 10 feet NGVD to 6 feet NGVD (designed to settle to the design elevation of 5 feet NGVD);
- Construction elevation of new levees reduced from 12 feet NGVD to 10 feet NGVD (designed to settle to the design elevation of 8 feet NGVD);
- Relocation of new outboard levee to 1,500 feet south or east of the existing BMK south lagoon levee, with the exception of the area between Pacheco Pond and the south lagoon levee where project design requires the levee remain 1,000 feet from the existing levee (prior location was all 1,000 feet or less from south lagoon in initial design);
- Improvements to levee west of the BMK south lagoon lock structure to minimize Novato Creek bypass flows to south lagoon;
- Removal of Spur Trail Option 2A to Novato Creek; routing of Bay Trail around west side of Headquarters Hill;
- Relocation of the interpretive center and access area from BMKV to the property currently owned by the City of Novato west of the HWRP (the "bulge" parcel); and
- Designation of primary construction road access from Nave Drive to New Hamilton Parkway, around Landfill 26 and to the HWRP and secondary access from Bel Marin Keys Boulevard

Overview of Revised Alternative 2

Figures 3-5 and 3-6 show Revised Alternative 2 at maturity. Under Revised Alternative 2, tidal (tidal marsh, tidal flat, subtidal) and nontidal (high-transitional marsh, seasonal wetlands, upland) habitat types would be restored to the expansion site. Imported dredged material (determined to be suitable wetland cover material by the DMMO) would be used to create upland and seasonal wetland habitats, and to create surface elevations suitable to accelerate the establishment of tidal marsh vegetation. Final marsh plain elevations would develop over time through the natural deposition of sediments from San Pablo Bay, supporting the establishment of tidal marsh vegetation. The acreage of each habitat type restored under Revised Alternative 2 is shown in table 3-4 below.

Table 3-4. Summary of Revised Alternative 2: Dredged Material Placement with Seasonal Wetland and Enlarged Pacheco Pond

Habitats	899 acres tidal wetland 120 acres subtidal and tidal mudflat habitat 277 acres seasonal wetland 21 acres open water (pond) 12 acres emergent freshwater wetlands 247 acres upland
Outboard Levee Breaches	Novato Creek (BMKV); San Pablo Bay (BMKV)
Novato Sanitary District Outfall	Access road/berm (4–6' NGVD) and extension of 400' of new pipeline around east side of Pacheco Pond. Authorized HWRP already includes replacement/retrofit of existing pipeline and relocation of dechlorination plant.
New Levees	From enlarged Pacheco Pond to Novato Creek (8–10' NGVD). Along north and south sides of seasonal wetland (8–10' NGVD) Around east side of enlarged Pacheco Pond (8–10' NGVD)
Improved Levees	BMK south lagoon (5–6' NGVD)
Water Management Structures/Pacheco Pond and BMK S. lagoon connections	Overflow structure from Pacheco Pond to seasonal wetland Overflow structure from seasonal wetland to tidal wetland area Culvert with flapgate in Novato Creek levee to drain swale area Modified BMK lagoon overflow
Bay Trail, Interpretive Center, and Access Area	Along southwest perimeter of HWRP and north from city levee and along east side of Pacheco Pond to Bel Marin Keys Blvd around the west side of Headquarters Hill. Interpretive center and access area on property currently owned by the City of Novato west of HWRP seasonal wetland area.

Tidal Wetland Design

In the eastern portion of the site, 2 tidally influenced sub-basins, each approximately 600 acres in size (the southern basin includes the SLC site), would be created as cells to facilitate the placement of dredged material and the establishment of tidal marsh vegetation. Dredged material would be placed in

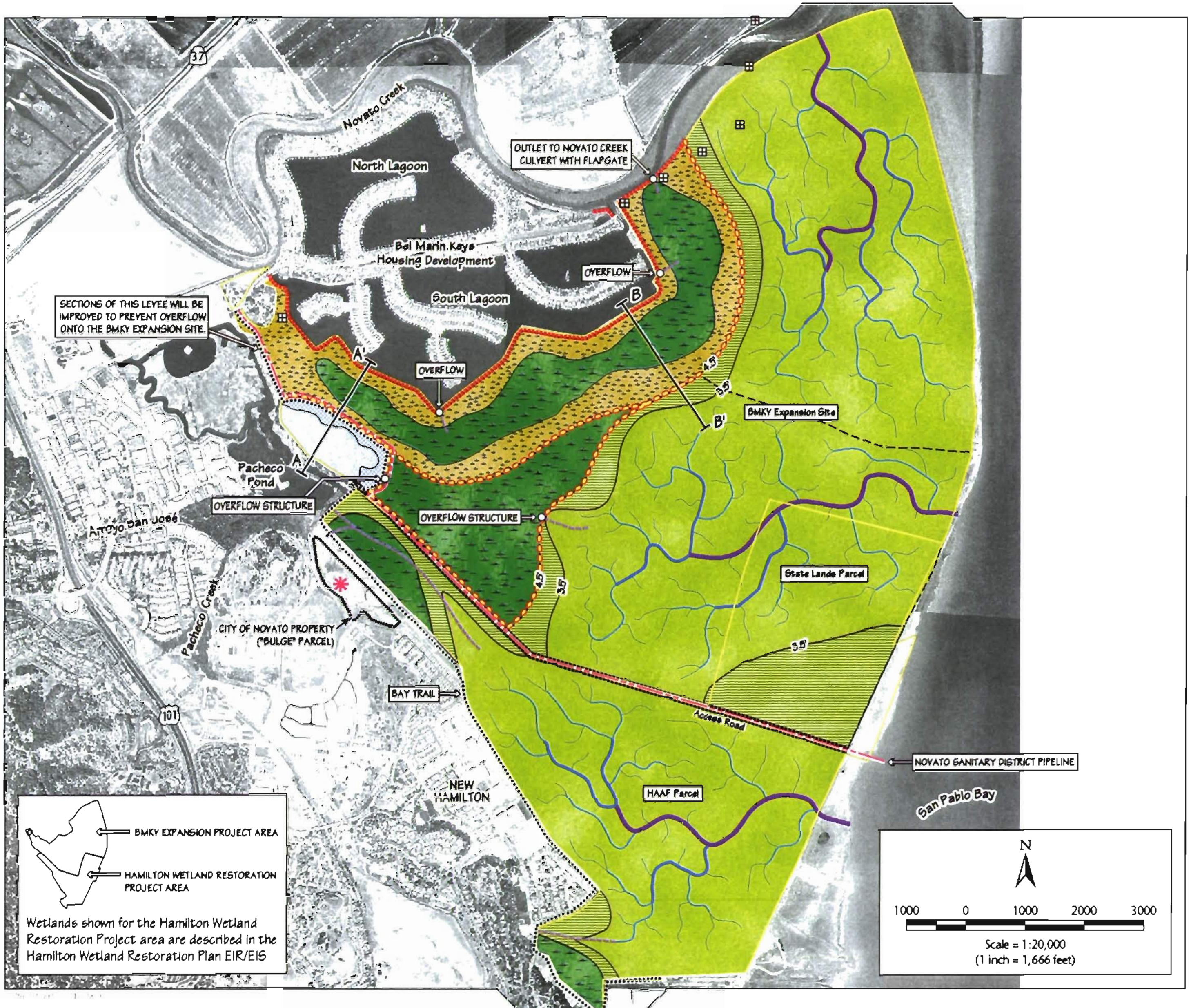

Figure 3-5
Bel Marin Keys Restoration
Revised Alternative 2 at Maturity

Legend

HABITAT TYPES
- Upland Transition
- Freshwater Emergent Wetland
- Seasonal Wetland
- High Transitional Marsh
- Tidal Salt Marsh
- Open Water

CHANNEL ORDER
- Primary channels
- Secondary channels
- Tertiary channels
- Small branches
- Sub-basin Boundary

INFRASTRUCTURE
- Parcel Boundary (see inset)
- Overflow Channel and Structure
- New Levee
- Improved Levee
- Existing Levee
- Bay Trail
- Power Tower
- Novato Sanitary District Pipeline
- Interpretive Center (not part of federal project; access area adjacent, not shown)

Notes:

Vertical elevations are relevant to NGVD 1929.

Sections of the levee north of Pacheco Pond will be improved to prevent overflow onto the BMKV expansion site.

See Figure 3-6 for cross sections A–A' and B–B'.

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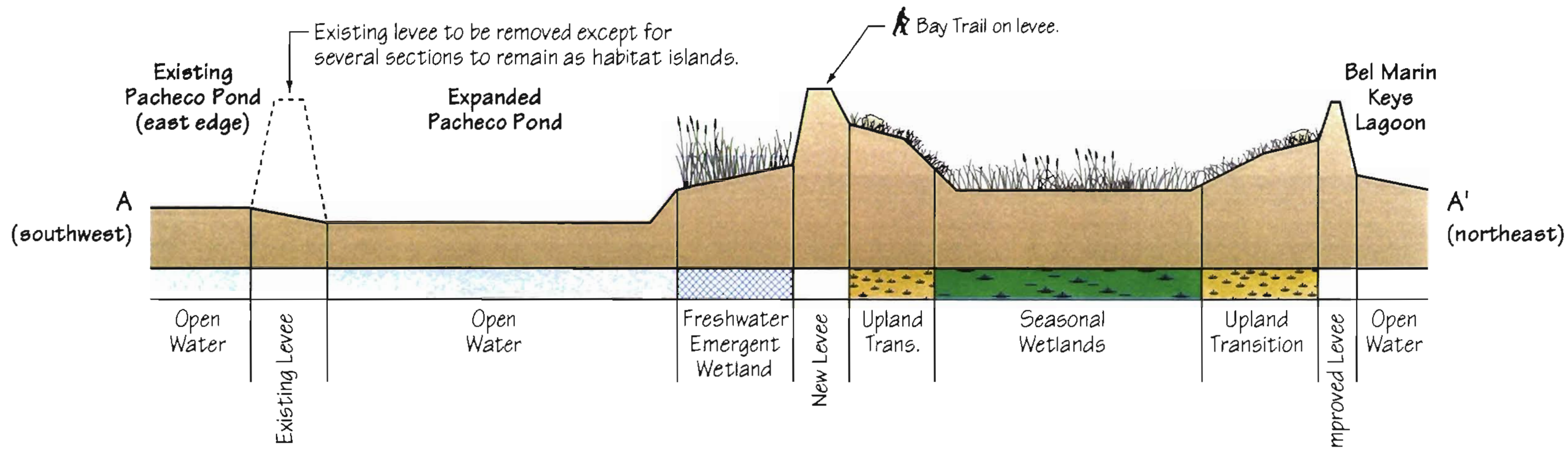
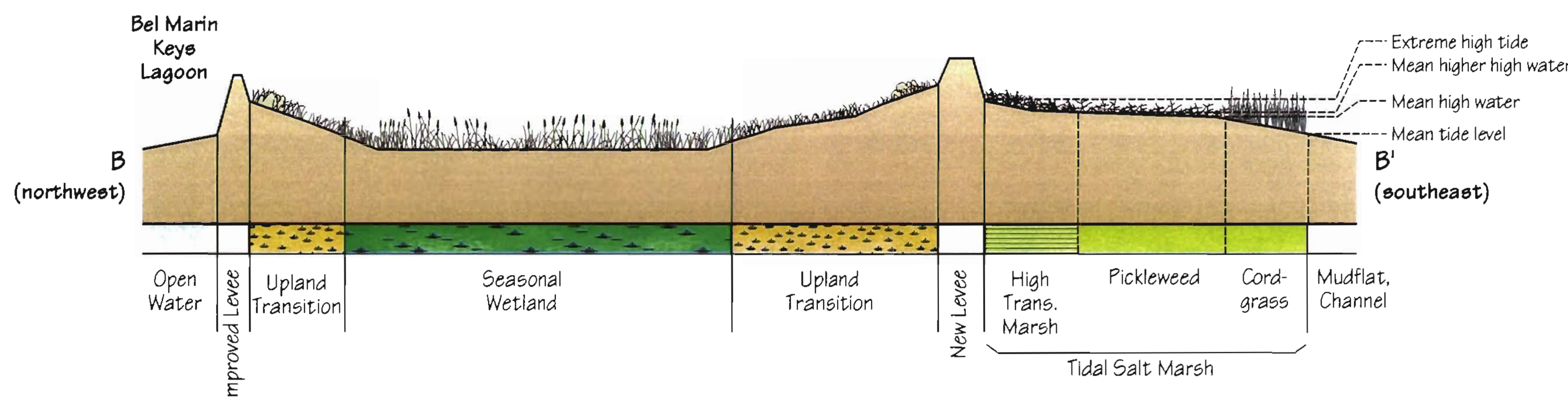
Revised Alternative 2: Cross Section A—A'



Revised Alternative 2: Cross Section B—B'



See Figure 3-5 for plan view of Revised Alternative 2 at maturity.

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Figure 3-6
Schematic Cross Sections of Habitats Restored under Revised Alternative 2

each sub-basin to create surface elevations ranging from approximately 2 feet NGVD (1 foot below MHW) along the basin perimeter to approximately 0 NGVD near the outboard levee. Additional dredged material would be placed in the southeast corner of the SLC site to create surface elevations (approximately 3.5 feet NGVD) suitable for the establishment of high-transitional marsh vegetation. Material would also be placed along the east side of the new outboard levee to create elevations suitable for the establishment of high-transitional marsh. After placement activities have been completed, the outboard levees would be breached in 2 locations to restore the hydrologic connections to San Pablo Bay and Novato Creek. The levee along Novato Creek would be lowered to facilitate overflow onto the expansion site from Novato Creek during peak storm events. The levee along San Pablo Bay would also be lowered to facilitate the establishment of mid-high marsh vegetation. Several small portions of the outboard levees would be left in place as high-tide refugia. Final marsh plain elevations would be established through the deposition of fine-grained sediments from San Pablo Bay and Novato Creek. Final surface elevations in the 2 marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD. Elevations in the channel bottoms would ultimately be lower, particularly at the breach.

Levees and BMK Lagoon Drainage

A new outboard levee running generally north–south with an initial elevation of approximately 10 feet NGVD (which includes a 2-foot settlement allowance, resulting in a design elevation of 8 feet NGVD) would be constructed across the middle portion of the site to separate the non-tidal and tidal habitats. The outboard (east) side of the levee would be constructed with a gentle side slope that would transition from upland to high- to mid-marsh habitat types. The inboard (west) side of the outboard levee would slope gradually from the crest of 10 feet NGVD to a base elevation of approximately –1.5 feet NGVD.

A new levee would cross from the new outboard levee to the east side of an expanded Pacheco Pond. This levee would separate a swale basin adjacent to the BMK south lagoon from a seasonal wetland basin to the south connected to Pacheco Pond. See figure 3-13 after page 3-38 of this section.

The existing levee along the BMK south lagoon would be improved to an initial top elevation of 6 feet NGVD, which includes a 1-foot settlement allowance, resulting in a design elevation of 5 feet NGVD. An overflow structure or structures would be installed to convey overflow from the south lagoon into the swale area. Overflow from the lagoon as well as seasonal precipitation would support the establishment of approximately 140 acres of seasonal wetland habitat in the swale basin. Plant species composition in this area would vary according to salinity and inundation frequency and duration; however, vegetation would likely consist of emergent wetland vegetation (e.g., bulrushes, cattails, rushes), and grasses and forbs. The swale basin would be about 387 acres overall including the 140-acre seasonal wetland and 247 acres of upland. The

approximate ponding capacity of the swale below 1.5 feet NGVD would be at about 450 acre-feet (AF). The capacity of the seasonal wetland would be greater than this amount due to the ability of this area to fill up to the elevation of the surrounding levee. For example if the swale were to fill to 3.5 feet NGVD, the ponded volume would be over 1000 AF.

Conceptual levee designs are shown in figure 3-13 after page 3-38 of this section.

Nontidal Habitat Design and Pacheco Pond Connection

Under Revised Alternative 2, Pacheco Pond would be expanded by 21 acres on its east side. The expanded pond would also include 12 acres of emergent marsh habitat on its east border with the Bay Trail. A new levee would be constructed around the new eastern boundary of Pacheco Pond. The existing Pacheco Pond levee would be breached in several locations to unify the existing and new portions of the pond. Several portions of the existing levee may be left in place to create habitat islands. The approximate additional ponding capacity in the expanded pond and emergent wetland (up to 7 feet NGVD) would be approximately 175 AF.

In the southwestern portion of the expansion site, approximately 136 acres of seasonal freshwater wetlands (e.g., cattails, bulrushes, sedges) would be created by constructing surrounding levees to impound freshwater flows and by routing overflow from the expanded Pacheco Pond. The outboard levee would also prevent the seasonal wetland habitat area from being inundated during high tides. An overflow structure would be installed in the new levee around the east side of the expanded Pacheco Pond levee to facilitate overflow into the seasonal wetland habitat area when surface water elevations in Pacheco Pond exceed 1.5 feet NGVD (the managed surface water elevation). A flow structure would be installed in the new outboard levee to allow the release of overflow waters from the seasonal wetlands into the tidal marsh basin. A significant portion of Pacheco Pond flood flows may be released into the tidal marsh basin via the seasonal wetland. The bottom elevation of the seasonal wetland would be approximately -1.5 feet NGVD. The ponding capacity of the seasonal wetland below 1.5 feet NGVD would be about 400 AF. The capacity of the seasonal wetland would be greater than this amount due to the ability of this area to fill up to the elevation of the surrounding levee. For example if the seasonal wetland were to fill to 3.5 feet NGVD, the ponded volume would be around 650 AF.

Under this alternative, Pacheco Pond would have 2 outlets: the existing outlet to Novato Creek via the outlet channel, and a new outlet to the seasonal wetland area on BMKV. DFG and MCFCWCD have an existing agreement to manage Pacheco Pond for the dual purposes of flood control and wildlife uses. The BMKV expansion would include development of a new water management plan for Pacheco Pond, which the Conservancy (or its successors), DFG, and MCFCWCD would jointly implement to continue to manage flood control and wildlife. The existing outlet would continue to operate and would receive all

flow in the dry season because the seasonal wetlands would not require dry season flow. The new water management plan would determine the operational parameters of the 2 outlets in the wet season and during high-stage/flow events.

Novato Sanitary District Outfall

The authorized HWRP includes the relocation of the NSD dechlorination plant and the replacement or retrofit of the existing NSD pipeline as described above under Alternative 1. This alternative includes construction of an access road/berm and construction of a new section of pipeline (approximately 400 feet) around the east side of the expanded Pacheco Pond

NSD would access the pipeline by existing, new, or improved levees leading to an improved berm along the existing alignment (at the property line separating BMKV from HAAF). The top of the berm would be built to between 4 and 6 feet NGVD, which is similar to Alternative 1, except that under Revised Alternative 2, a 2,000-foot section of levee southeast of Pacheco Pond would be built to between 8 feet and 10 feet NGVD because this portion would separate the seasonal wetland area from a part of the HAAF parcel that could receive tidal flow.

Bay Trail, Interpretive Center, and Access Area

Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field, and then proceed along the southwestern perimeter of the HWRP to a point approximately 700 feet from the existing outboard marsh, as described above for Alternative 1(routing of the Bay Trail at Hamilton is shown on figure 3-5 and on figure 4-10 in the *Biological Resources* section in chapter 4).

Also under this alternative, the Bay Trail would proceed northward from the City of Novato levee along the western edge of the HWRP to Pacheco Pond, cross the levee between Pacheco Pond and the HWRP, proceed around the east side of the expanded Pacheco Pond, and then proceed northward along the levee between Pacheco Pond and BMKV to Bel Marin Keys Boulevard around the west side of Headquarters Hill. This trail would be entirely on state or federal property. Revised Alternative 2 does not include a spur trail option to Novato Creek.

In addition, an interpretive center for the HWRP and BMKV expansion would be located on property currently owned by the City of Novato in the same location as described above under Alternative 1. The interpretive center is conceptually envisioned as an approximately 1,000-square-foot building that would house exhibits that provide information about the wetland restoration projects and the local flora and fauna. The interpretive center would serve as a trailhead and would be connected to the proposed Bay Trail route by new trails along existing dirt roads.

Since the interpretive center will be placed on lands that are not required for federal project purposes, and since Corps policy greatly limits expenditures for educational facilities, the interpretive center will not be a project feature to be paid for or constructed by the federal government. The land required for the interpretive center is outside the Federal project. However, the project design has accommodated the interpretive center construction, which would be carried out by others. The federal government will be able to share the expenses of some recreation features, including a parking area (approximately 10-20 spaces), restrooms, and information kiosks. These features would take up about 2 acres and are referred to collectively in this document as the "access area." Only land required for these approved features can be cost-shared by the Federal government.

Habitat Benefits

Revised Alternative 2 would provide 899 acres of tidal wetland, 120 acres of other tidal habitats, 277 acres of seasonal wetland, 21 acres of open water, 12 acres of emergent wetland and 247 acres of upland. Restoration of the proposed habitats would benefit numerous special-status and common wildlife species, similar to Alternative 1, except that Revised Alternative 2 would include a comparatively larger seasonal wetland component, smaller pond component, and slightly smaller tidal marsh component. See discussion of the species that would be expected to utilize restored habitats above under "Habitat Benefits" for Alternative 1.

Construction Approach, Revised Alternative 2

Construction activities that would be implemented under Revised Alternative 2 to restore salt marsh, seasonal wetland, and upland habitats at the BMKV site are similar to Alternative 1. This section discusses any differences to the activities described for Alternative 1. As in Alternative 1, construction activities to restore habitats on the site would be implemented in 3 phases.

- Phase 1 – Site Preparation
- Phase 2 – Dredged Material Placement
- Phase 3 – Earthwork, Revegetation, and Tidal Connection

Figure 3-7 illustrates the construction effort associated with Revised Alternative 2.

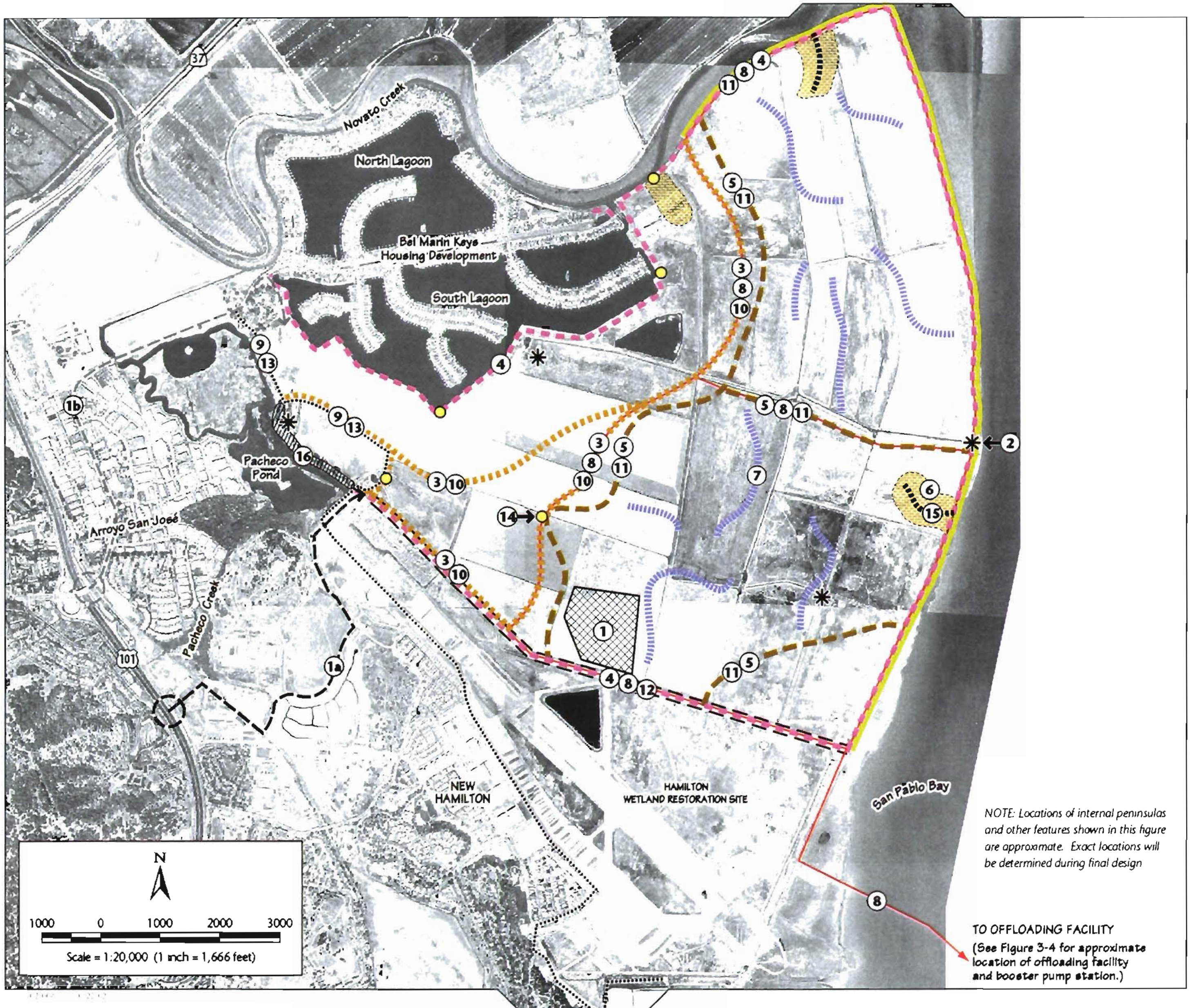

Figure 3-7
Construction Approach for
Bel Marin Keys Revised Alternative 2

Phase 1: Site Preparation

(1) Create staging area ( ) and site access:

(1a) = Hamilton Wetland Restoration Project (primary access);

(1b) = Bel Marin Keys Boulevard (secondary access).

(2) Demolish existing infrastructure (e.g., barn, structures, etc.).

(3) Construct new levees.

(4) Construct/improve perimeter levees/berms.

(5) Construct phase levees/berms.

(6) Construct water quality detention ponds and excavate pilot channels.

(7) Construct internal peninsulas.

(8) Construct dredged material placement infrastructure:
- delivery pipe,
- distribution pipes along levees, and
- multiple outlets.

(9) Construct Bay Trail as part of levee work in Phase 1

Phase 2: Dredged Material Placement
(Note: this phase is not shown in the figure.)

1. Pump dredged material.
2. Decant water.
3. Treat decanted water and discharge.

Phase 3: Earthwork, Revegetation, and Tidal Connection

(10) Return raise of levees to 10 feet NGVD.

(11) Lower phase levees ( ) and outboard levees ( ).

(12) Construct NSD sanitary line access road

(13) Complete Bay Trail improvements.

(14) Install water management structures

(15) Excavate connecting channels and breaches

(16) Establish connection to Pacheco Pond.

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Phase 1 – Site Preparation

Create Staging Area and Site Access

The staging area would be the same as that described above for Alternative 1. The primary construction site access route would be from Nave Drive and New Hamilton Parkway around Landfill 26 to the HWRP. The secondary construction site access route would be from Bel Marin Keys Boulevard.

Modify and Remove Existing Infrastructure

Activities would be similar to that for Alternative 1.

Excavate and Salvage Topsoil

This activity would be similar to Alternative 1, except that the area of potential use for salvage topsoil for seasonal wetland restoration would be far larger.

Construct Levees

Levee construction and design would be similar to that described for Alternative 1, however, the location and length of levees differs as shown in the design figures and noted below.

New and Improved Levees/Berms

New levees, approximately 21,000 feet in length, would be constructed across the middle and western portions of the site to create habitat features (e.g., freshwater seasonal wetlands), to separate the tidal and non-tidal portions of the site, and to provide appropriate levels of flood protection for adjacent landowners. These new levees would be constructed to an initial elevation of 10 feet NGVD (which includes a 2-foot settlement allowance, resulting in a design elevation of 8 feet NGVD). In order to maintain the 8-foot-NGVD design elevation, It will be necessary to return twice after initial settling has occurred and raise the levee to 10' NGVD again. This would occur approximately 6.5 years and 13 years after commencement of construction. The second raising of the levee would occur just prior to final breaching of the last tidal cell.

Approximately 36,400 linear feet of existing levees/berms along the perimeter of the site would be improved to facilitate the placement of dredged material. The improved levee along the Bel Marin Keys south lagoon would be constructed to an initial elevation of 6 feet NGVD (which includes a 1-foot settlement allowance, resulting in a design elevation of 5 feet NGVD). Much of the existing levee is already at 5 feet NGVD, and construction effort at those locations would be less than at several low points where the lagoon levee reaches between approximately 2 and 3 feet NGVD.

Under this alternative, the berm along the southern perimeter of the site (between BMKV and HAAF) would be built to 4 to 6 feet NGVD in the area east of the seasonal wetland area on the BMKV site. Construction of the berm may also include improvements to several short sections of the western perimeter levee.

Improvements to approximately 440 feet of the existing levee west of the BMK south lagoon lock have been added to the levee construction.

Since the trail design may mean that the Bay Trail is to be located on top of or on the slope of an existing, new, or improved levee, trail construction would be incorporated during levee work in Phase I. The trail would not be open for use during periods of construction because of safety concerns. Trail improvements such as gates, signs, or other elements would be added as soon as feasible, consistent with construction activities.

Phase Levees

Prior to transporting and placing dredged material, a series of internal levees (approximately 19,200 linear feet) would be constructed within the expansion site to facilitate phasing. The expansion site would be divided into 2 subunits based on drainage basin size and configuration.

Interior Berms and Peninsulas

A series of berms and interior peninsulas (approximately 18,200 linear feet) would be constructed within the marsh basins for the reasons described under Alternative 1.

Construct Water Quality Detention Ponds

The expansion site would be subdivided into drainage basins approximately 600 acres in size (corresponding to the phase units described previously). A pilot channel approximately 150 feet wide and 800 feet long would be excavated in each marsh basin. The operation of the ponds would be as described above for Alternative 1.

Construct Dredged Material–Related Infrastructure

Material Off-loading Facility

This facility would be the same as described above for Alternative 1.

Primary Delivery Pipeline

This facility would be the same as described above for Alternative 1.

Booster Pump Facility

This facility would be the same as described above for Alternative 1.

Secondary Distribution Pipelines

This facility would be the same as described above for Alternative 1.

Phase 2 – Dredged Material Placement

Pump Dredged Material

Approximately 13.8 million additional cubic yards of dredged material (beyond that in the authorized HWRP) would be imported to the expansion site for creation of tidal and nontidal habitats, which is 600,000 cubic yards more than

Alternative 1. Dredged material would originate from the same sources as described in Alternative 1. Pumping activity would be the same as described above for Alternative 1.

The Corps and Conservancy are willing to accept dredged material from BMK CSD and MCFCWCD (from Novato Creek dredging events) if they are determined to be suitable wetland cover material by the DMMO, their reuse is cost-effective to the project and the timing and other parameters of the dredge material's availability are consistent with the project implementation process.[2]

Treat Decanted Water and Discharge

Handling of decant water would be the same as described above for Alternative 1.

Phase 3 – Earthwork, Revegetation, and Tidal Connection

Return Levee Improvement of New Levees

In order to maintain the 8' NGVD design height, it would be necessary to raise the new levee to 10' NGVD about 6.5 years after initial construction and again just prior to breaching of the outboard levees, which is anticipated to occur approximately 13 years after commencement of construction. This will allow for the initial settling to occur during the construction period and maintenance of the design height.

Grade Phase Levees to Finished Grade

This activity would be the same as described above for Alternative 1.

Create Habitats Through Use of Salvaged Topsoil

This activity would be the same as described above for Alternative 1.

Seed/Plant Nontidal Habitat Areas

This activity would be the same as described above for Alternative 1.

Install Water Management Structures

During the final phases of construction, a number of flow control structures (e.g., culverts, weirs) (see figure 3-5) would be installed to facilitate future water management activities. An overflow structure would be installed in the new levee around the east side of the expanded Pacheco Pond to facilitate overflow into the seasonal wetland habitat. An overflow structure (equivalent in capacity to six 4-foot by 4-foot box culverts) would be installed in the new outboard levee to enable the release of overflow waters from the seasonal wetland habitat area into the tidal marsh basin. The existing overflow from the BMK lagoon located in the northern portion of the site would be modified and additional culverts would be installed to facilitate overflow into the constructed swale during storm events. An additional culvert with a flapgate, approximately 48 inches in width, would be installed in the existing Novato Creek levee to allow the swale to drain into Novato Creek.

Complete Trail Improvements

Trail construction would be conducted in Phase I along with levee work, since the Bay Trail would be constructed along existing and new levees on the west side of BMKV. Trail improvements, such as gates, fences, signs, benches, and other elements, would be built as soon as feasible, consistent with construction activities.

Excavate Connecting Channel and Breach Levees

Upon completion of dredged material placement activities, the water quality detention basins would be filled to the final placement grade, pilot channels approximately 150 feet wide by 800 feet long would be excavated in each marsh basin, and the perimeter levee would be breached to restore the tidal connection with San Pablo Bay and Novato Creek. This activity would be the same as described above for Alternative 1, although only two breaches, rather than three would be excavated. On either side of the San Pablo Bay levee breach, the outboard levee would be lowered to an elevation between MHW and MHHW to create topographic diversity, promote establishment of mid- to high-marsh vegetation, and provide refugia for wildlife species. Additionally, the levee along Novato Creek would be lowered to approximately MHW to facilitate overflow onto the expansion site from Novato Creek during peak storm events. Levee breaching and grading and channel excavation would involve a variety of heavy equipment, including track-, mat-, or pad-mounted excavators; backhoes; bulldozers; dump trucks; draglines; and/or a suction dredge.

The existing Pacheco Pond levee would be breached in several locations to unify the existing and new portions of the pond. Several portions of the existing levee may be left in place to create habitat islands. The adjacent portions of the Pacheco Pond levee (e.g. not within the new pond area) would remain.

Construction Timing, Revised Alternative 2

Under Revised Alternative 2, overall site construction is estimated to last approximately 13 years; anticipated overall durations of the 3 construction phases are as follows.

- Phase 1: Site preparation – 2 years
- Phase 2: Dredged material placement – 10 years (includes placement and dewatering and consolidation)
- Phase 3: Earthwork and tidal connection – 1 year

As noted above, this alternative includes two tidal sub-basins and other habitat areas such as the swale and the seasonal wetland area, separated by either temporary or permanent levees. Restoration activities could be conducted based on sub-basin boundaries and/or habitat types, to allow for sequential creation of habitat. Fill could be placed either sequentially or concurrently in different basins and/or habitat types. As one example of the sequential approach, dredged

material placement in one of the tidal cells would take about 5 years. Upon completion of dredged material placement, breaching of this tidal cell could take place prior to filling of the other cell. For the first tidal cell, construction time to tidal breach could be around 8 years in a sequential approach.

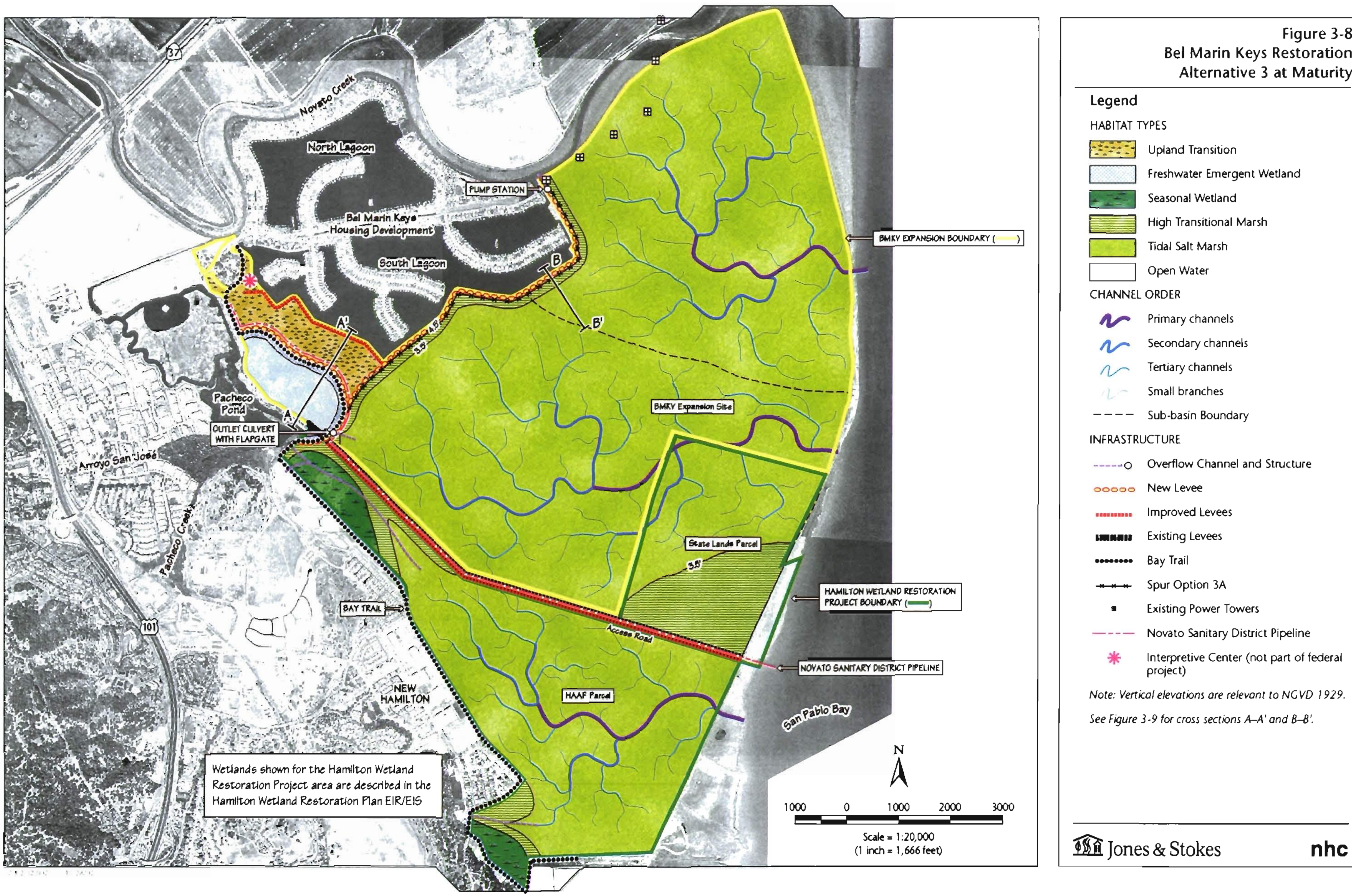
The Revised Alternative 2 schedule is also dependent in part upon completion of the FUDS remedial activities on the SLC parcel on the authorized HWRP site. Because there is no separating levee between BMKV and the SLC parcel in this alternative, breaching into the southern cell cannot be completed until the FUDS remedial activities have been completed and the placement of additional dredged material to create high tidal marsh has been completed.

Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond

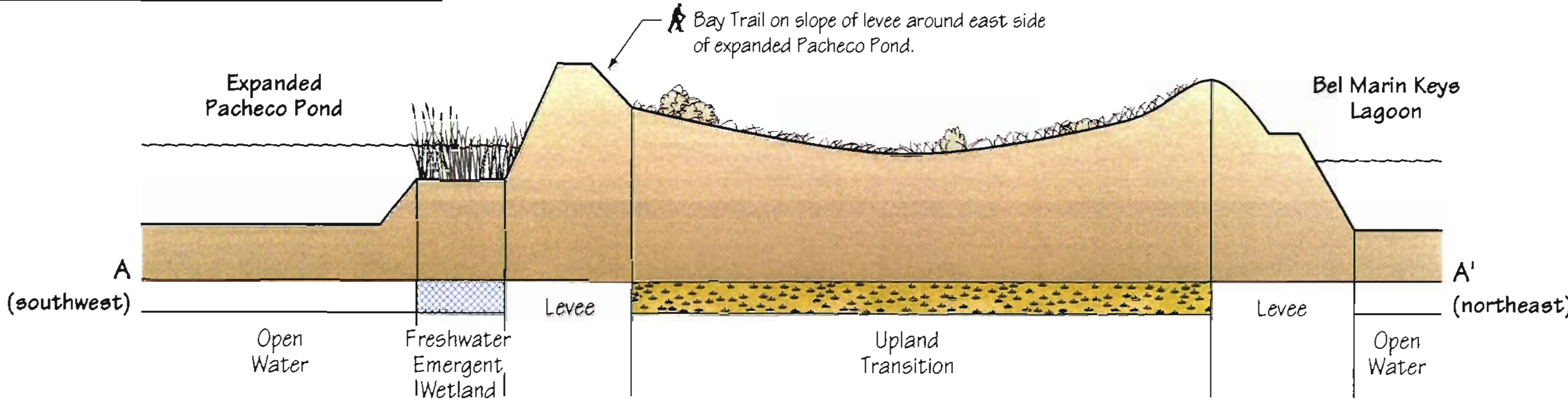
Overview of Alternative 3

Figures 3-8 and 3-9 show Alternative 3 at maturity. Under Alternative 3, tidal (tidal marsh, tidal flat, subtidal) and nontidal (high-transitional marsh, emergent wetlands, perennial open water and upland) habitat types would be restored to the expansion site. Site soils and sediments would be used to establish the base for the high transitional marsh and upland transition on the majority of the expansion site. On 90 acres in the southeastern corner of the SLC parcel, dredged material would be placed to established high transitional marsh habitat. Final marsh plain elevations and vegetation would become established over time through the natural deposition of sediments from San Pablo Bay. The acreage of each habitat type that would be restored under Alternative 3 is shown in table 3-5.

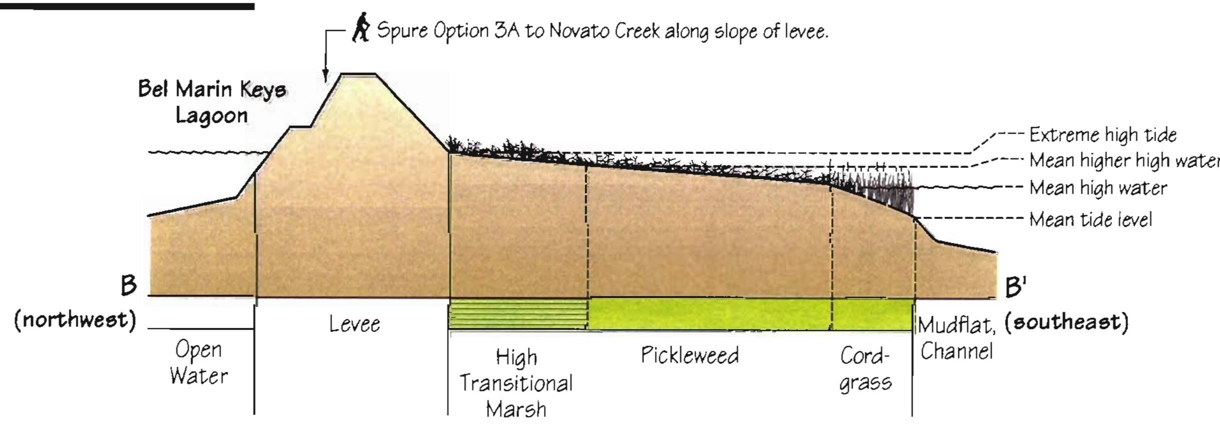
Figure 3-8
Bel Marin Keys Restoration
Alternative 3 at Maturity



Alternative 3: Cross Section A—A'



Alternative 3: Cross Section B—B'



See Figure 3-8 for plan view of Alternative 3 at maturity.

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Figure 3-9
Schematic Cross Sections of Habitats Restored under Alternative 3

Table 3-5. Summary of Alternative 3: Natural Sedimentation with Enlarged Pacheco Pond

Habitats	1,274 acres tidal wetland 197 acres subtidal and tidal mudflat habitats 40 acres of open water 10 acres of emergent marsh 55 acres upland
Outboard Levee Breaches	San Pablo Bay (BMKV); San Pablo Bay (BMKV)
Novato Sanitary District Outfall	New pipeline along east side of Pacheco Pond with access road/berm (4–6' NGVD). Authorized HWRP already includes replacement/retrofit of existing pipeline and relocation of dechlorination plant.
New Levees	Immediately south of BMK south lagoon to Novato Creek (8–12' NGVD). Along east side of expanded Pacheco Pond.
Improved Levees	BMK south lagoon (6–10' NGVD)
Water Management Structures/Pacheco Pond and BMK south lagoon connections	Culvert with flapgate on east side of expanded Pacheco Pond Pump to accommodate BMK lagoon overflow near BMK lock
Bay Trail, Interpretive Center and Access Area	Along southwest perimeter of HWRP and north from City levee and along east side of expanded Pacheco Pond to Bel Marin Keys Blvd. Spur Option 3A from Pacheco Pond to Novato Creek. Interpretive Center and Access Area on northwest side of BMKV.

Tidal Wetland Design

In the eastern portion of the site, 2 tidally influenced sub-basins, each approximately 700 acres in size, would be created as cells to facilitate the establishment of tidal marsh vegetation. The outboard levee would be breached in 2 locations to restore the hydrologic connection to San Pablo Bay. Final marsh plain elevations would be established through the natural deposition of fine-grained sediments from San Pablo Bay. Final surface elevations in the 2 marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD.

Levees and BMK Lagoon Drainage

A levee with an initial elevation of approximately 12 feet NGVD (which includes a 4-foot settlement allowance, resulting in a design elevation of 8 feet NGVD) would be constructed along the northwestern portion of the site following the existing BMK south lagoon levee. The outboard (east) side of the levee would be constructed with a gently sloping bench, approximately 100 feet wide, to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat. The inboard (west) side of the levee would slope gradually from the crest of 12 feet to a base elevation of 5 feet below NGVD. The western portion of the existing BMK south lagoon levee near Bel Marin Keys Boulevard would be improved to an initial top elevation of 10 feet NGVD (which includes a

4-foot settlement allowance, resulting in a design elevation of 6 feet NGVD). A pump would be installed near the east navigation lock to convey overflow from the south lagoon into Novato Creek.

A second bench, also approximately 100 feet wide, would be constructed along the north side of the existing levee that separates the expansion site from the HAAF parcel to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat.

Conceptual levee designs are shown in figure 3-12 after page 3-38 of this section.

Nontidal Habitat Design and Pacheco Pond Connection

In the northwestern portion of the expansion site, approximately 50 acres of perennial open water and wetland habitat would be created by enlarging Pacheco Pond. The levee that now separates the expansion site from Pacheco Pond would be breached in several locations to provide a larger contiguous area of open water habitat. Sections of the levee would be left in place to provide nesting habitat for shorebirds. The bottom elevation of Pacheco Pond would remain at the existing elevation of –3 feet NGVD, and the pond would continue to be managed to maintain a surface water level of approximately 1.5 feet following enlargement of the pond. A bench would be constructed along the inboard perimeter of the new pond levee to promote the establishment of freshwater emergent vegetation. A culvert structure would be installed in the new pond levee to allow the release of overflow waters from the pond into the tidal marsh basin.

Under this alternative, Pacheco Pond would have 2 outlets: the existing outlet to Novato Creek via the outlet channel, and a new outlet to the tidal wetland area on BMKV. DFG and MCFCWCD have an existing agreement to manage Pacheco Pond for the dual purposes of flood control and wildlife. The BMKV expansion would include development of a water management plan for Pacheco Pond, which the Conservancy or successors, DFG, and MCFCWCD would jointly implement to continue to manage flood control and wildlife.

Novato Sanitary District Outfall

The authorized HWRP includes relocation of the NSD dechlorination plant and replacement/retrofit of the existing pipeline. Under this alternative, a new outfall extension would be installed around the east side of the expanded Pacheco Pond, and an access road/berm would be added to the HWRP. The existing pipeline would be replaced or retrofitted as part of the HWRP because of potential differential settling and leakage (U.S. Army Corps of Engineers 2001b). If a new pipeline is installed, it would be installed slightly below the grade of the existing pipeline; the existing pipeline would be abandoned in place to provide protection from potential scour associated with the formation of tidal channels. The new NSD pipeline would be placed in a new alignment around the eastern side of

Pacheco Pond. The pipeline would be installed deeper than the invert for the outlet culverts from Pacheco Pond to the tidal wetland restoration area.

NSD would access the pipeline by existing or new levees leading to an improved berm along the existing alignment (at the property line separating BMKV from HAAF). The top of the berm would be built to between 4 and 6 feet NGVD.

As part of the authorized HWRP project, the existing NSD dechlorination plant would be relocated to NSD's Ignacio Treatment Plant, Novato Treatment Plant, or another suitable location. Relocating the dechlorination plant would avoid the need to provide an alternative power supply to the plant and would make the plant more easily accessible to NSD personnel for operation and maintenance.

Bay Trail, Interpretive Center and Access Area

Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field. and then proceed along the southwestern perimeter of the HWRP to a point approximately 700 feet from the existing outboard marsh, as described for Alternative 1 (routing of the Bay Trail at Hamilton is shown on figure 3-8 and on figure 4-10 in the *Biological Resources* section in chapter 4).

Also under this alternative, the Bay Trail would extend northward from the City of Novato levee along the western edge of the HWRP to Pacheco Pond, then cross the levee between Pacheco Pond and the HWRP, then follow the expanded Pacheco Pond levee, and then proceed northward to Bel Marin Keys Boulevard. This alignment is entirely on state or federal property.

Spur Option 3A would include a spur trail extending eastward from the Bay Trail at Pacheco Pond along the proposed levee that separates the upland buffer/swale area from restored tidal wetlands to the BMK south lagoon, and then proceeding east along the new levee south of the BMK south lagoon levee to Novato Creek. This spur would terminate at Novato Creek, where a gate would be installed to prevent trail users from entering the BMK residential area.

Under this alternative, an interpretive center for the HWRP and BMKV expansion would be constructed on the northwestern portion of the expansion site, south of Bel Marin Keys Boulevard. The features of the center are the same as described for the other alternatives; only the location is different.

Corps policy greatly limits expenditures for educational facilities and thus the interpretive center will not be a project feature to be paid for or constructed by the federal government. However, the project design has accommodated the interpretive center construction, which would be carried out by others. The federal government will be able to share the expenses of some recreation features, including a parking area (approximately 10-20 spaces), restrooms, and information kiosks.

Habitat Benefits

Alternative 3 would provide 1,274 acres of tidal wetland; 197 acres of other tidal habitats; 40 acres of open water; 10 acres of emergent marsh, and 55 acres of upland. Restoration of the proposed habitats would benefit numerous special-status and common wildlife species for tidal and non-tidal areas restored, similar to Alternative 1, except Alternative 3 would not include any seasonal wetlands.

Construction Approach, Alternative 3

Construction activities that would be implemented under Alternative 3 to restore salt marsh, an expanded Pacheco Pond, and upland habitats at the BMKV site are similar to Alternative 1. This section discusses any differences to the activities described for Alternative 1. As in Alternative 1, construction activities to restore habitats on the site would be implemented in 3 phases.

- Phase 1 – Site Preparation and Earthwork
- Phase 2 – Dredged Material Placement (on 90 acres on SLC site only)
- Phase 3 – Revegetation and Tidal Connection

In this alternative, the placement of dredged material is limited to 90 acres on the SLC site. Figure 3-10 shows the construction effort associated with Alternative 3.

Phase 1 – Site Preparation

Create Staging Area and Site Access

This activity would be similar to that described above for Alternative 1.

Modify and/or Remove Existing Infrastructure

This activity would be the same as that described above for Alternative 1.

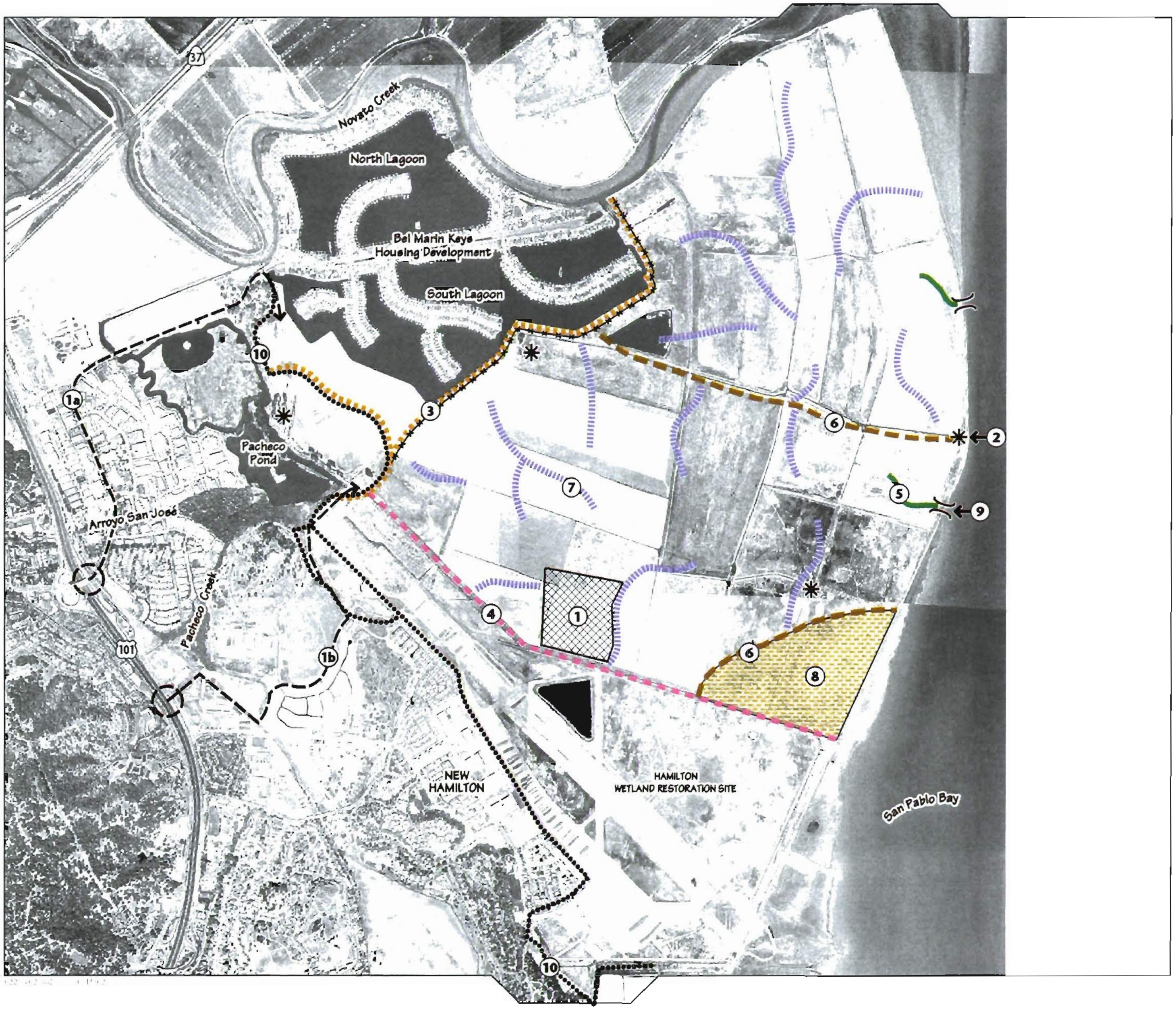
Excavate and Salvage Topsoil

This activity would be the same as that described above for Alternative 1, except that salvaged topsoil would not be used for construction of seasonal wetlands, since none are included in this Alternative.

Construct Levees

A variety of levees would be constructed on the expansion site to facilitate creation of habitat features and to provide appropriate levels of flood protection for adjacent landowners. A dredged-material placement levee would be built on the southeast portion of the SLC parcel. Design parameters and function would vary by levee type. Site preparation techniques and construction activities would typically be the same as that described for Alternative 1 above.

Figure 3-10
Construction Approach for
Bel Marin Keys Alternative 3



Phase 1: Site Preparation

- (1) Create staging area ( ) and site access ( ):
  - (1a) = Bel Marin Keys Boulevard;
  - (1b) = Hamilton Wetland Restoration Project.
- (2) Demolish existing infrastructure (e.g., pump facility and other structures).
- (3) Construct new levees.
- (4) Improve existing levees/berms.
- (5) Excavate pilot channels.
- (6) Construct phase levees/berms.
- (7) Construct internal peninsulas.

Phase 2: Dredged Material Placement

- (8) Place dredged material (in coordination with Hamilton Wetland Restoration Project).

Phase 3: Earthwork, Revegetation, and Tidal Connection

- (9) Excavate connecting channels and breaches.
- (10) Construct Bay Trail ( ) and potentially Spur Option 3A ( )

NOTE: Locations of internal peninsulas and other features shown in this figure are approximate. Exact locations will be determined during final design.

N

1000 0 1000 2000 3000

Scale = 1:20,000 (1 inch = 1,666 feet)

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New and Improved Levees/Berms

A new levee (approximately 11,000 feet) would be constructed across the western portion of the site to create habitat features (e.g., open water and freshwater emergent wetlands) and provide appropriate levels of flood protection for adjacent landowners. A gently sloping bench, approximately 100 feet wide, would be constructed along the outboard side of the containment levee to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat.

Approximately 9,000 linear feet of existing levees/berms would be improved to protect adjacent parcels. The berm along the southern perimeter of the site (between BMKV and HAAF) would be constructed to 4 to 6 feet NGVD under this alternative. A second bench, approximately 100 feet wide, would be constructed along the north side of the existing levee that separates the expansion site from the HAAF parcel to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat.

Since this alternative included a pumping station, vehicle access to the pumping station would be necessary. The new levee along the BMK south lagoon would need to be designed to accommodate vehicle access for maintenance, fueling, and service of the pump station. It may also be necessary to install an electrical line in the levee to reach the pump station if the pumps are electrically driven.

Phase Levee

Prior to restoring tidal action, an internal levee (approximately 6,500 linear feet) would be constructed within the expansion site to facilitate phasing. The site would be divided into 2 subunits based on drainage basin size and configuration.

Interior Berms and Peninsulas

A series of berms and interior peninsulas (approximately 26,500 linear feet) would be constructed within the marsh basins to promote sediment settling, reduce resuspension of sediments due to wind/wave mixing, decrease fetch, and reduce wave erosion of perimeter and containment levees.

One of the internal berms would enclose the 90-acre dredged material placement cell in the southeastern corner of the SLC parcel. The berm would have a minimum top width of 4 feet and a elevation of approximately 2 feet above the finished placement grade. Dredged materials would be placed in this cell in coordination with material placed on the adjacent HAAF site.

Phase 2 – Dredged Material Placement

Pump Dredged Material

Dredged material would only be used on 90 acres in the southeast corner of the SLC parcel under this alternative. Pumping activity would be the same as Alternative 1, except the scale of activity would be significantly lower due to the use of dredged material on 90 acres on the SLC parcel and no use of dredged material to establish tidal elevations on the BMKV site.

Approximately 1,200,000 cubic yards of dredged material would be imported to the southeast corner of the SLC site to create high transitional marsh habitat on 90 acres. Overall, this alternative would result in using 2.6 million cubic yards less of dredged material than the authorized HWRP, due to the reduction in the amount of material placed on the SLC site. Dredged material would originate in the same sources noted above for Alternative 1. Placement and draining operations would continue until the desired surface elevations (3.5 feet NGVD) have been reached in the 90-acre area.

Material Off-loading Facility

This facility would be the same as described above for Alternative 1.

Primary Delivery Pipeline

This facility would be the same as described above for Alternative 1, except that it is likely that the pipeline alignment would be on the HAAF site.

Booster Pump Facility

This facility would be the same as described above for Alternative 1.

Secondary Distribution Pipelines

This facility would only extend onto the SLC site.

Treat Decanted Water and Discharge

As solids settle from the slurry, clarified water would be decanted and discharged to a water quality detention pond at the mouth of the main channel at the breach nearest the 90-acre area (location to be determined). This activity otherwise be that same as that described above for Alternative 1.

Phase 3 – Soil Placement, Revegetation, and Tidal Connection

Create Habitats through Use of Salvaged Topsoil

This activity would be the same as in Alternative 1.

Seed/Plant Nontidal Habitat Areas

This activity would be the same as in Alternative 1.

Install Water Management Structures

During the final phase of construction, a number of flow control structures (e.g., culverts, weirs) would be installed to facilitate future water management activities. An overflow structure (equivalent in capacity to six 4-foot by 4-foot box culverts) would installed in the new Pacheco Pond levee to enable the release of overflow waters from the pond into the tidal marsh basin.

A pump with an outfall to Novato Creek would be installed near the eastern navigation lock to pump water from the BMK south lagoon during large storm events. If the pump uses diesel or gasoline fuel, then a fuel storage tank would need to be built at the pump station, including any necessary fuel spill containment areas for fuel transfers and tank containment.

Excavate Connecting Channel and Breach Levee

Upon completion of site preparation activities, pilot channels approximately 150 feet wide and 800 feet long would be excavated in each marsh basin, and the perimeter levee would be breached to restore the tidal connection with San Pablo Bay.

Construction Timing, Alternative 3

Under Alternative 3, site construction is expected to last approximately 5 years. Anticipated durations of the 3 phases are as follows.

- Site preparation – 2 years
- Dredged material placement – 1 to 2 years (includes placement, dewatering, and consolidation)
- Earthwork and tidal connection – 6 months to 1 year

The Alternative 3 schedule is dependent in part upon completion of the FUDS remedial activities on the SLC parcel on the authorized HWRP site. Because there is no separating levee between BMKV and the SLC parcel under this alternative, breaching into the southern cell could not be completed until the FUDS remedial activities have been completed and the placement of additional dredged material to create high tidal marsh has been completed. In the event that FUDS remedial activity is not completed when construction commences for this alternative, the construction duration could be longer than 5 years or could be separated into a number of phases for the 2 separate cells.

Comparison of Restoration Alternatives

Table 3-6 is a summary comparison of the activities proposed under each restoration alternative. Alternatives 1 and 2 rely on placement of clean dredged materials as fill to establish a grade close to the final desired condition, with

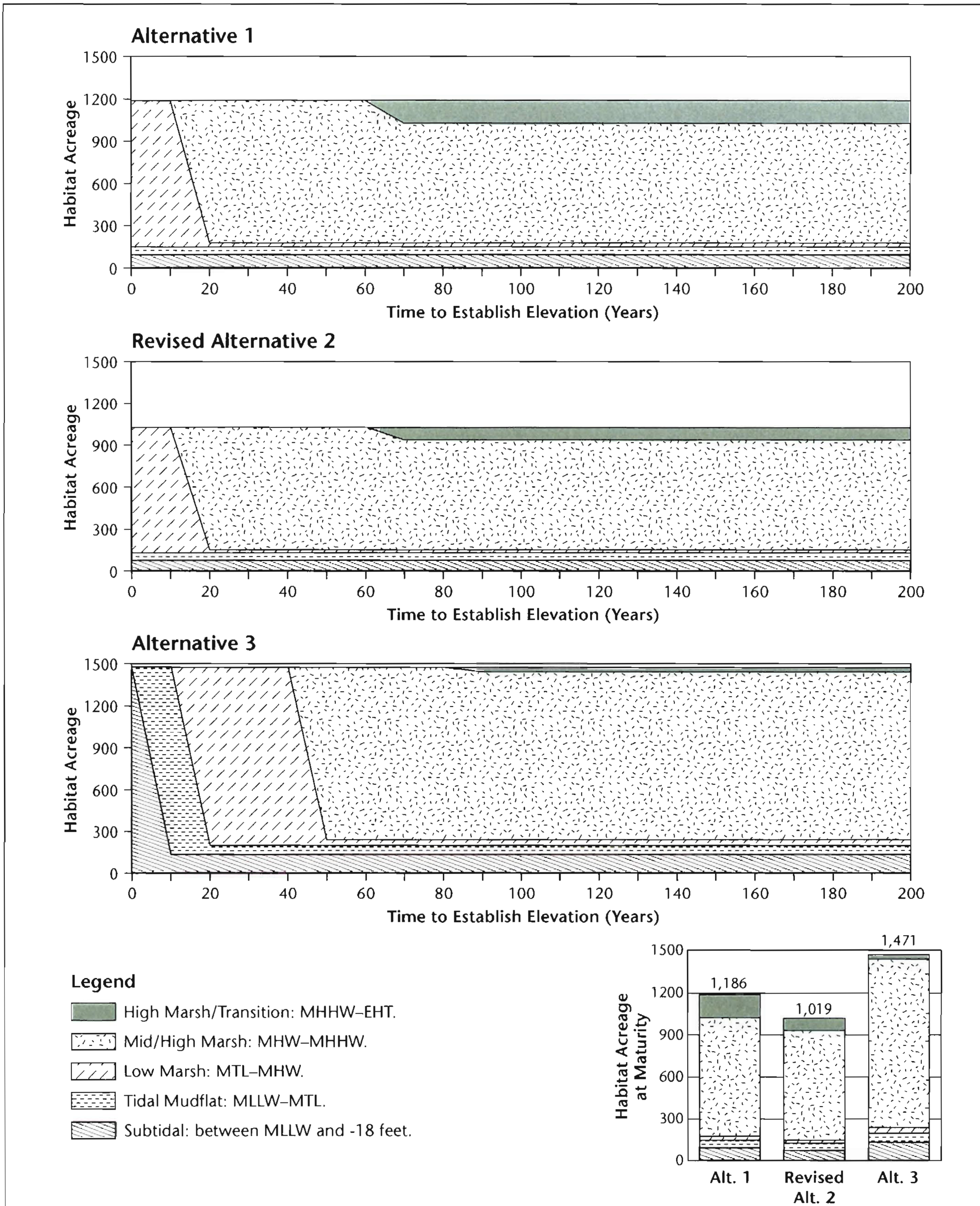
natural processes responsible for development to final conditions over time. Alternative 3 relies on natural depositional and erosional processes for all phases of restoration development, except for a small (90-acre) area in the southeastern portion of the site, where dredged materials would be placed. The principal differences between the 3 alternatives are related to

1. logistical and time considerations associated with dredged material placement, including construction of infrastructure for delivery and placement of dredged materials (Alternatives 1 and 2);
2. time to establishment of desired habitat conditions (all 3 alternatives); and
3. size and number of different habitat components.

Figure 3-11 shows the anticipated development of appropriate elevations for restored habitat after reestablishment of tidal connectivity for Alternatives 1, 2, and 3. The use of dredged materials to establish initial surface elevations in Alternatives 1 and 2 would greatly decrease the amount of time required for the establishment of tidal marsh vegetation and development of the desired habitat types in comparison with the time required for the establishment of appropriate elevations under the natural sedimentation approach in Alternative 3. Dredged material placement would thus provide habitat in a shorter amount of time for those species that use tidal marsh and associated aquatic habitats, as well as seasonal wetlands, freshwater marshes, and upland transition habitats. However, Alternative 3 would provide a greater amount of tidal wetlands, though several decades later than the alternatives that use dredged material. As described above and in the *Biological Resources* section in chapter 4, tidal wetlands provide suitable habitat for a number of threatened, endangered, rare, and common species.

While not shown in figure 3-11, freshwater vegetation establishment in seasonal wetland areas in Alternatives 1 and 2 would vary depending on whether dredged material or salvaged onsite soil were used as final wetland cover. Use of onsite soil is expected to result in earlier establishment of freshwater seasonal wetland vegetation but may also result in a greater amount of non-native vegetation establishment.

Figures 3-12 and 3-13 show the different conceptual designs for new levees, improved levees, an access berm, and the internal peninsulas.



Jones & Stokes

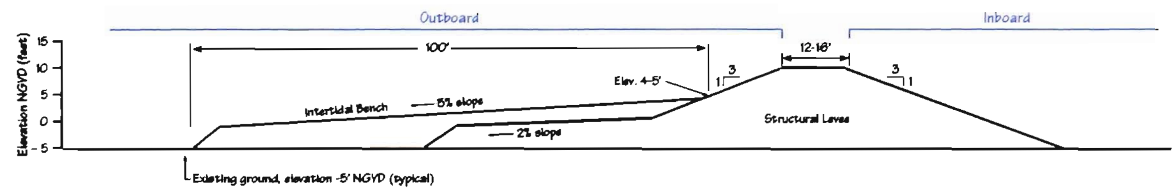
nhc northwest hydraulic consultants

Figure 3-11
Tidal Habitat Elevation Evolution for Bel Marin Keys Alternative 1, Revised Alternative 2, and Alternative 3

Figure 3-12
Typical New and Improved Levee Cross Sections – Alternatives 1 and 3

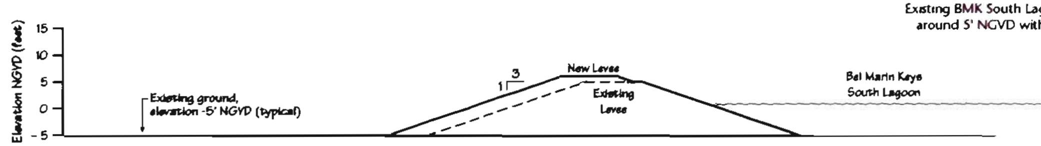
New Levee Structure

100-year tide ~ 6.5' NGVD[a]
MHHW ~ 3.0 to 4.0' NGVD
2 foot settlement to design height of 8' NGVD

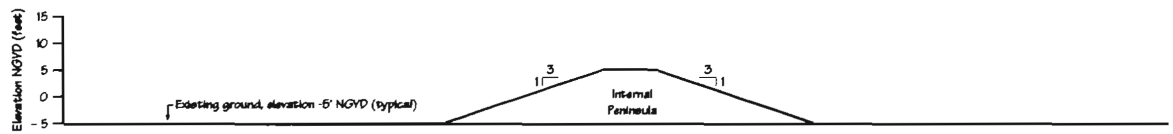


Improved Levee Structure

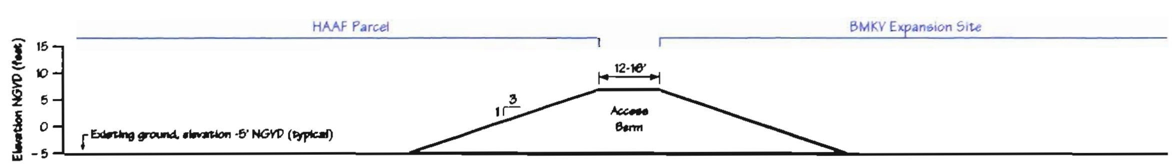
1 foot settlement to design height of 5' NGVD
Existing BMK South Lagoon levee is mostly at elevations around 5' NGVD with several low points around 2-3' NGVD.



Internal Peninsulas



Novato Sanitary District Access Berm[b, c, d]



Notes:

[a] The 100-year tide is based on an estimate of 6.5 feet NGVD by the USACE (1984). For design purposes, this has been adjusted upward to 7 feet to account for the effects of a number of factors: mean sea level rise; wind-induced set-up within San Pablo Bay; wave runup on the adjacent mudflat; flood runoff from the Sacramento-San Joaquin Delta; and uncertainties in the estimation methods (U.S. Army Corps of Engineers 1998).

[b] Under Revised Alternative 2, access will be provided by the new levee constructed along the southern perimeter of the seasonal wetland habitat area and the access berm.

[c] Under Alternative 3, an intertidal bench will be constructed along the northern side of the access berm adjacent to the BMKV Expansion Site.

[d] The height of the access berm would be between 4 and 6 feet. Under Revised Alternative 2, the portion of the access berm adjacent to the seasonal wetland area at BMKV will be 7 feet.

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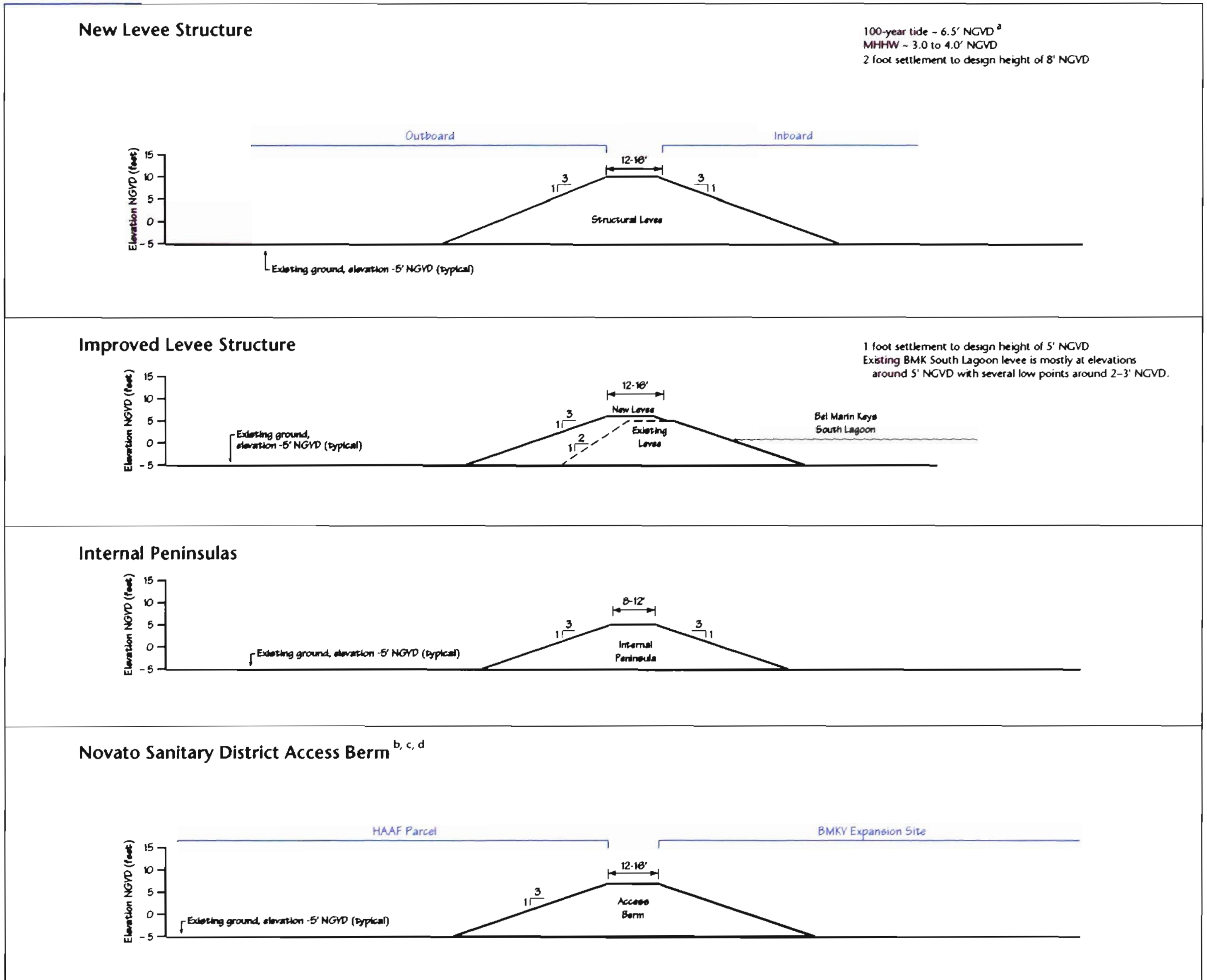

Figure 3-13
Typical New and Improved Levee Cross Sections
Revised Alternative 2

Notes:

[a] The 100-year tide is based on an estimate of 6.5 feet NGVD by the USACE (1984). For design purposes, this has been adjusted upward to 7 feet to account for the effects of a number of factors: mean sea level rise; wind-induced set-up within San Pablo Bay; wave runup on the adjacent mudflat; flood runoff from the Sacramento-San Joaquin Delta; and uncertainties in the estimation methods (U.S. Army Corps of Engineers 1998).

[b] Under Revised Alternative 2, access will be provided by the new levee constructed along the southern perimeter of the seasonal wetland habitat area and the access berm.

[c] Under Alternative 3, an intertidal bench will be constructed along the northern side of the access berm adjacent to the BMKV Expansion Site.

[d] The height of the access berm would be between 4 and 6 feet. Under Revised Alternative 2, the portion of the access berm adjacent to the seasonal wetland area at BMKV will be 7 feet.

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Table 3-6. Summary Comparison of Features Associated with the Expansion Alternatives

	Expansion Alternatives		
	Alternative 1	Revised Alternative 2	Alternative 3
Earthwork			
New Levees	13,300 linear feet	21,000 linear feet	11,400 linear feet
Improved Levees/Berms	37,500 linear feet	36,400 linear feet	8,800 linear feet
Phase Containment Levees	30,400 linear feet	19,200 linear feet	6,500 linear feet
Internal Peninsulas/Berms	15,800 linear feet	18,200 linear feet	26,500 linear feet
Pilot Channel Excavation	2,100 linear feet	1,800 linear feet	1,200 linear feet
Dredged Material			
Dredged Material	13,200,000 cubic yards	13,800,000 cubic yards	1,200,000 cubic yards[a]
Time to Construct			
Site Preparation	2 years	2 years	2 years
Dredge Material Placement	10 years	10 years	1–2 years
Earthworks and Tidal Connections	1 year	1 year	0.5–1 year
Habitat Acreage			
Upland Transition	300 acres	247 acres	55 acres
Open Water	40 acres	21 acres	40 acres
Freshwater Emergent Wetland	10 acres	12 acres	10 acres
Seasonal Wetland	40 acres	277 acres	0 acres
High Transitional Marsh	160 acres	79 acres	30 acres
Tidal Marsh	849 acres	792 acres	1,204 acres
Low Marsh[b]	30 acres	28 acres	40 acres
Tidal Mudflat[c]	57 acres	48 acres	67 acres
Subtidal[d]	90 acres	72 acres	130 acres
Water Management			
Pacheco Pond: Modeled Change in Water Surface (10-year scenario; see Appendix B)	–1.9 feet	-1.8 feet	–1.9 feet
Pacheco Pond: Modeled Change in Water Surface (100-year scenario; see Appendix B)	–0.4 feet	-1.3 feet	–0.4 feet
Pacheco Pond: Change in Estimated Flood Storage Volume	+375 acre-feet	+650 acre-feet (in seasonal wetlands below 3.5' NGVD)	+375 acre-feet
Novato Creek: Change in Peak Water Surface Elevation (10-year storm event)	No change	No change	No change
Novato Creek: Change in Invert Elevation Downstream of Breach	–0.5 feet	–0.5 feet	No change

	Expansion Alternatives		
	Alternative 1	Revised Alternative 2	Alternative 3
Time to Establishment of Target Elevations for Vegetation			
Mud Flat	0 years	0 years	5 years
Low Marsh	0 years	0 years	15 years
Mid-High Marsh	10 years	10 years	40 years

[a] Represents fill associated with placement of dredged material on 90 acres on the southeast corner of the SLC parcel
[b] MSL–MHW
[c] MLLW–MSL (includes 2 acres of existing tidal mudflat on property)
[d] MLLW

Alternatives and Alternative Features Dismissed from Further Consideration

Based on input received from the technical and public workshops conducted in fall 2001, a range of alternatives and alternative features was developed for consideration. These alternatives and features incorporated various options to meet the HWRP purpose and need as well as options to avoid or reduce some of the potential impacts of certain aspects of habitat restoration at the BMKV site. The full range of alternatives and features developed was evaluated for feasibility; ability to satisfy the stated HWRP purpose, need, goal, and objectives; and potential environmental effects. Based on this evaluation, a number of alternatives and alternative features were dismissed from further consideration, and Alternatives 1, 2, and 3 were selected as representing a reasonable range of alternatives for analysis in the SEIR/EIS. The following sections describe the alternatives and alternative features evaluated but dismissed from detailed consideration. Tables 3-7 and 3-8 provide a summary comparison of the alternatives and features dismissed from detailed consideration.

Table 3-7. Alternatives Considered but Eliminated from Detailed Analysis

Alternative Number	Descriptive Name	Summary	Key Screening Considerations
4	Varying Habitat Mixes	Create/restore a mosaic of habitats with <80 percent tidal component	Provides less habitat for special-status species than Alternative 1, 2, or 3
5	"Historic" Bay/Wetland Restoration	Restore site to circa-1850 habitat mosaic	Provides less habitat for common and special-status species than Alternative 1, 2, or 3
6	Hybrid of Dredged Material and Natural Sedimentation Approaches	Place dredged material as fill on part of the site and allow natural sedimentation to establish habitats on remainder of site	Represents "middle ground" between use of dredged material and natural sedimentation approaches; intent captured by range of 3 alternatives
7	Smaller Restoration Project	Limit fill/levee activities to the maximum allowed by existing F-2 zoning and drainage agreements (approx. 372 acres)	Does not meet intent of project sponsors and provides far more limited benefits to endangered species than Alternatives 1, 2, or 3.

Table 3-8. Alternative Features Considered but Eliminated from Detailed Analysis

Feature Number	Descriptive Name	Summary	Key Screening Considerations
8	Alternative Bay Trail Alignment along Outboard Levee	Route Bay Trail along outboard marsh levee with pedestrian bridges over breaches	Conflicts with conservation of habitat for special-status species; long-term management considerations; cost
9	Alternative Novato Sanitary District Wastewater Alignment	Route new NSD alignment along northern levee or along cell drainage divide; construct new outfall in San Pablo Bay	Divides site from Novato Creek; places new outfall close to mouth of Novato Creek. Significant impacts with only limited benefits.
10	In-Kind Replacement of Agricultural Wetlands	Replace existing agricultural. wetlands with restored agricultural wetlands or a greater amount of seasonal wetland acreage	Provides less habitat for special-status species than Alternative 1, 2, or 3; replacement of agricultural habitat with out-of-kind wetlands in Alternative 1, 2, and 3 is considered ecologically appropriate. Requires additional maintenance for agriculture.
11	Extension of Tidal Reach to Pacheco Pond	Eliminate levee separating Pacheco Pond from BMKV and breach outboard levees	Eliminates flood benefits of Pacheco Pond; eliminates brackish habitat in Pacheco Pond; does not create a diverse array of habitats; provides no obvious benefits.
12	Removal of Berm Separating BMKV and HAAF Sites	Eliminate the berm separating the 2 restoration sites	Eliminates barrier to site integration but does not accommodate NSD outfall

Feature Number	Descriptive Name	Summary	Key Screening Considerations
13	Alternative Breach Location on Novato Creek	Move the breach location closer to the existing navigation lock	Conflicts with provision of upland buffer between site and BMK residences/lagoon; may create conflicts between sensitive wildlife and residential/recreational uses
14	Reclaimed Wastewater Alternative	Use reclaimed wastewater to enhance freshwater flows and habitats on site	Wastewater use not a purpose of HWRP; has potential to create water quality issues; flow augmentation unnecessary to achieve desired habitat acreages
15	Single Large-Basin, Single-Breach Alternative	Design the tidal portion of the site with only 1 basin and 1 breach	Single breach may not be adequate to support full hydraulic and biological function on restored marshlands; provides no obvious benefits
16	Flood Control Alternative Feature 1	Route Novato Creek flood flows through BMK south lagoon to large holding pond on BMKV (suggested by MCFCWCD based on 1993 BMKV EIR)	Flood control beyond that needed to mitigate project effects is not a purpose of the project. Holding area would eliminate ability to restore large portions of the site to tidal wetland. Alternatives 1, 2, and 3 determined not to have adverse physical effect on flooding.
17	Flood Control Alternative Feature 2	Construct a bypass channel starting near Highway 37 and move existing north-side Novato Creek levees northward (suggested by MCFCWCD based on 1993 BMKV EIR)	Flood control beyond that needed to mitigate project effects is not a purpose of the project. Bypass channel on lands not owned or under control of project sponsors. Impacts to existing habitat in creek. Impacts to use of land for NSD spray irrigation. Alternatives 1,2, and 3 determined not to have adverse physical effect on flooding.

Alternative 4 – Varying Habitat Mosaics

Possible alternative habitat mosaics ranged from leaving the site in its present state to providing significantly less tidal marsh habitat and more seasonal marsh habitat to providing only tidal marsh habitat. The goal of the HWRP is to create a diverse array of wetland and wildlife habitats at HAAF and BMKV in order to benefit a number of special-status species as well as other migratory and resident species; the "all or nothing" alternatives, such as providing only tidal marsh habitat, were dismissed from further consideration because they would fail to provide a diversity of habitat. One of the needs for the HWRP is to provide habitat for endangered species; in the context of San Francisco Bay, this means providing habitat for endangered tidal marsh species, such as the salt marsh harvest mouse and the California Clapper Rail. Thus, alternatives that did not provide for restoration of substantial areas of tidal marsh were also dismissed from further consideration. Although a nearly infinite range of possible habitat

mosaics remain, the alternatives selected for detailed evaluation represent a reasonable range of habitat options, and other alternatives offering different percentages of the various habitat types were dismissed from further consideration.

Alternative 5 – "Historic" Bay/Wetland Restoration

Circa 1850, the Bay shoreline was located near the eastern edge of the BMK south lagoon. Approximately half of the current BMKV site was part of the Bay at that time, while the remaining western portion of the site supported a tidal marsh complex that received freshwater flow directly from Pacheco Creek and Arroyo San Jose as well as overflow from Novato Creek (Pacheco Pond was built in the 1970s). It would be possible to restore this circa-1850 habitat mosaic by constructing a new outboard levee (built to an elevation between MHW and MHHW, with several breaches to allow tidal flow) along the approximate alignment of the 1850 shoreline, lowering the existing outboard levees, and placing dredged materials as fill or allowing natural sedimentation to create new tidal marsh on the western half of the site. Flow from Arroyo San Jose and Pacheco Creek would be diverted to discharge into the restored wetland area. This alternative was dismissed from further consideration because it would create far less tidal marsh habitat than Alternatives 1, 2, and 3, and thus would not meet the HWRP objectives as well as these alternatives.

Alternative 6 – Hybrid of Dredged Material and Natural Sedimentation Approaches

Representing a "middle ground" between Alternatives 1–2 and Alternative 3, this alternative would place dredged material to create appropriate elevations for wetland restoration on a part of the site, and would rely on natural sedimentation for wetland restoration on the remainder of the site. This alternative was dismissed from further consideration because the 3 alternatives selected for analysis include a range that captures the intent of this alternative. If a dredged material placement alternative is selected for implementation and the availability of dredged material of suitable quality becomes a limiting factor at some point in the future, this alternative may be reevaluated.

Alternative 7 – Smaller Restoration Project

This alternative would include placement of dredged material, establishment of levees, and tidal breaching on a far smaller portion of the BMKV site than envisioned under Alternatives 1, 2, and 3. The purpose of this alternative would be to avoid filling, creation of levees, placing structures, or undertaking any other activity that would result in diminishment of the nominal ponding capacity of the

site by greater than 25%, while maintaining the acreages of existing drainage agreements. The end result would be a restoration area of approximately 317 acres in size. This alternative could comply with the county flood zoning ordinances and existing drainage agreements. Levee structures, buffer areas, and a potential Bay Trail would reduce further the available area for wetland restoration. This alternative would result in far fewer benefits to endangered and other wetland-dependent species and would only represent a marginal addition to the habitat value overall of the HWRP. Further, this alternative does not meet the intent of the Conservancy when it purchased the property nor the intent of the Corps in early consideration of the potential to add BMKV to the HWRP. This alternative was dismissed from further analysis after completion of the first hydrologic study on the BMKV site and on Alternatives 1, 2, and 3 that showed that the expansion would not have an adverse effect on flooding in the local area. A second hydrologic study is being conducted presently on a broader study area to confirm the results of the first study. If this second study identifies an adverse physical hydrologic impact of the restoration alternatives analyzed in this document, then this alternative may be reconsidered for evaluation. In addition, if resolution about the F-2 zoning cannot be reached in a way that allows Alternative 1, 2, or 3 to proceed, this alternative may be reconsidered at some point in the future.

Alternative Feature 8 – Alternative Bay Trail Route

This alternative included a Bay Trail along the San Pablo Bay and Novato Creek outboard levees. It required pedestrian bridges over breaches in the levee and would have necessitated maintenance of levee integrity.

This alternative was dismissed from further consideration for the following reasons: it is inconsistent with the proposed Bay Trail route; it is inconsistent with the adopted HWRP; it would prevent lowering of the outboard levees to allow integration of the restored tidal wetlands with Novato Creek and San Pablo Bay; it would likely result in public access conflicts with threatened and endangered species and their habitats; it is inconsistent with current City of Novato planning for the Bay Trail; and it would generate long-term management costs.

Alternative Feature 9 – Alternative Novato Sanitary District Wastewater Alignments

Possible alternative locations for the new Novato Sanitary District (NSD) pipeline alignment included: routing the pipeline along the central crossing levee and the BMKV/Novato Creek levee, and routing the pipeline along 1 of the drainage divides between the tidal cells. The alternative routings would have permitted lowering the BMKV/HAAF berm to allow integration of the tidal marsh restoration areas over time. Either routing would require ongoing

maintenance of an access road and construction of a new outfall to San Pablo Bay.

The alignment along the northern side of the BMKV site was dismissed from further consideration for the following reasons: except for a potential breach location, a berm for an access road along Novato Creek would remain in place, preventing the integration of the restored tidal wetland with Novato Creek; installation of the new pipeline would require disturbance to the outboard marsh; and location of the outfall near the mouth of Novato Creek could affect water quality in the creek.

The alignment along the drainage divide between the new northern tidal cell and the adjacent cell was dismissed from further consideration for the following reasons: this alignment would require construction of a berm for an access road along the drainage divide, which would segregate the northern tidal cell from the rest of the site; additional construction would be necessary for the new berm; and the new outfall would be located closer to the mouth of Novato Creek and could affect water quality in the creek.

Although constructing the new pipeline along the existing alignment would require ongoing maintenance of most of the BMKV/HAAF berm to ensure continuing access for maintenance of the NSD line, the HAAF and BMKV sites are believed to encompass sufficient tidal marsh acreage to buffer the segregation effects of the NSD line. In addition, the existing outfall location is as far as possible from the mouth of Novato Creek. If future changes in wastewater routing or treatment technology eliminate the need for this outfall, it might be possible to lower the berm/access road to promote better integration of the sites.

Alternative Feature 10 – In-Kind Replacement of Agricultural Wetlands

One of the identified HWRP goals stipulates that the project shall incur "no net loss of wetland habitat presently provided at the BMKV and HAAF sites" (see chapter 1). The preliminary design phase examined several alternative means of achieving this goal.

The 1997 LSA wetland delineation, which was certified by the Corps, identified 155 acres of nonagricultural jurisdictional wetlands and 151 acres of agricultural jurisdictional wetlands. The 151 acres of agricultural wetlands identified in the delineation represent a statistically derived estimate of average ponding acreage within the cultivated fields. Flooded fields provide foraging and resting habitat for a wide diversity of wintering and migrant shorebirds, waterfowl, and other water birds during winter.

> Analysis of "no net loss of wetland habitat" for wetland restoration projects in diked former baylands that are used for agriculture poses unique questions for project sponsors. Acreage is the measure historically used in discussions of

compensatory mitigation related to the Corps' national "no net loss" policy, primarily because it has been difficult to identify a single standard for all of the functional components considered during the physical and ecological evaluation required for decision making. "No net loss" is most broadly interpreted as requiring replacement of any lost wetland acreage at a ratio of at least 1:1, but while no net loss remains Corps policy, as described in the October 31, 2001 Regulatory Guidance Letter, more focus is now being placed on ecosystem approaches to the resource needs of adjacent and surrounding watersheds in developing appropriate mitigation (U.S. Army Corps of Engineers 2001a).

Exact in-kind replacement of the 151 acres of agricultural wetlands would require retention of at least 151 acres in agriculture and creation of appropriate surface topography to allow those 151 acres to pond every year. Retention of agriculture would require maintenance of these areas, which does not meet the HWRP objective of minimizing active management. Preservation of agricultural activity on the site is not among the goals of the HWRP and would likely result in conflict between agricultural use and the protection and enhancement of resources, and was thus dismissed from further consideration.

In-kind replacement of the 151 acres of agricultural wetlands by creating/restoring seasonal wetlands is feasible at the site. However, any additional seasonal wetland acreage at the site would be created/restored at the expense of acreage that could be devoted to restoring tidal marsh for the benefit of tidal marsh–dependent species, including special-status species. Moreover, ponded agricultural habitat is not considered a limiting factor for wildlife along the northern rim of San Pablo Bay.

Alternative Feature 11 – Extend Tidal Reach to Pacheco Pond

An alternative eliminating the levee separating Pacheco Pond from BMKV and constructing no central crossing levee would be feasible if dredged material was placed as fill to raise the existing site grade on BMKV and at Pacheco Pond. Under this scenario, tidal flow would affect the entire pond, changing the existing brackish environment, and could extend farther upstream into Pacheco Creek and Arroyo San Jose. This alternative was dismissed from further consideration for the following reasons: it could create flooding problems on lands surrounding Pacheco Pond; existing brackish and freshwater environments would be lost; it would conflict with the existing MCFCWCD–DFG agreement about maintenance of brackish habitat in the pond; and it would not create a diverse array of habitats.

Alternative Feature 12 – Removal of Berm Separating BMKV and HAAF

Complete removal of the berm separating BMKV and the HAAF site would allow integration of the restored tidal marsh and seasonal wetland environments. This alternative was dismissed from further consideration because of the need for the expansion to accommodate the existing NSD outfall pipeline and the potential replacement pipeline and permit periodic maintenance of the existing and future outfall. Breaching a portion of the berm was also considered to allow partial integration of the tidal marsh restoration areas, but was dismissed because of the difficulty to maintain NSD access and the need for maintenance of either temporary or permanent bridging structures.

Alternative Feature 13 – Alternative Breach Location on Novato Creek

A breach could be located on Novato Creek near the existing BMK navigational lock. This alternative breach location was dismissed from further consideration because it would conflict with the provision of an upland buffer adjacent to the BMK residential area and lagoon, and would place tidal marsh habitat in close proximity to residential and recreational users.

Alternative Feature 14 – Reclaimed Wastewater Alternative

Reclaimed wastewater from either the NSD or the Ignacio Sanitary District could be used to enhance freshwater flows to the expansion restoration site. This alternative was dismissed from further consideration for the following reasons: reuse of wastewater is not among the purposes of this expansion; using reclaimed wastewater in a wetland project adjacent to a residential area has the potential to raise water quality issues such as depressed dissolved oxygen content (depending on the quality of the reclaimed water); and flow augmentation would not be necessary to achieve the desired wetland habitats on the site. Other potential problems associated with this alternative include the potential for objectionable odors resulting from use of reclaimed wastewater.

Alternative Feature 15 – Single Large-Basin, Single-Breach Alternative

This alternative would design the tidal portion of the site with only 1 basin and 1 breach to reduce the area of existing tidal marsh and mudflat that would be lost

due to the creation of new tidal channels. Depending on the size designed for tidal marsh, a single basin could be between 1,000 and 1,400 acres in size. Based on experience with other wetland restoration projects and an understanding of the hydrology of existing tidal marshes, there are concerns about whether a single breach would be capable of providing sufficient tidal flows to promote natural channel formation and to provide full tidal exchange to a basin of this size (Jones & Stokes 2002). A further concern is that use of a single breach/single basin would not allow a phasing approach that could allow cells to be completed and opened to tidal action in sequence. This alternative was dismissed from further consideration because of this potential failure to provide hydraulic and biological functionality on restored wetlands and the elimination of potential phasing of wetland restoration.

Alternative Feature 16 – Flood Control Alternative Feature 1

This alternative feature was suggested by MCFCWCD for analysis. This alternative was described in the 1993 EIR prepared for the proposed residential development and golf course at BMKV. This alternative feature was proposed in the 1993 EIR as a means of reducing peak flood stage at Highway 37 to 7 feet NGVD to provide an equivalent to the "ultimate channel" described in the Marin County flood control ordinance (Environmental Science Associates 1993).

This alternative feature would route Novato Creek flood flows through the BMK south lagoon by taking water via culvert when stage on Novato Creek reaches 7 feet NGVD, and discharging it to a large detention basin on the BMKV parcel. The detention basin would be closed to tidal action and would be designed to drain at low tide. This feature would include construction of an additional culvert from Novato Creek to the BMK south lagoon at the location of the 3 western culverts between the creek and the lagoon, as well as construction of conveyance structures from BMK south lagoon to the detention basin, and the detention basin to San Pablo Bay.

Flood control (outside of mitigation, where significant adverse physical effects on flooding are identified) is not a purpose of the HWRP or the BMKV expansion. As described in chapter 4 of this document, the hydrologic and hydraulic analysis concluded that the 3 restoration alternatives selected for analysis in this document would not have an adverse physical effect on flooding, and that, even if it were determined that the project is inconsistent with the local flood zoning ordinance, this would not be a significant effect on the environment. A flood control feature is not necessary as mitigation because no significant physical adverse effect has been identified. Furthermore, maintenance of a large portion of the site as a detention basin would severely limit the amount of the site that could be restored to tidal wetlands or other habitats, which would not meet the goal and objectives of the project. Thus, after consideration, this alternative feature was dismissed from further analysis in this document.

Alternative Feature 17 – Flood Control Alternative Feature 2

This alternative feature was also suggested by MCFCWCD for analysis and was also described in the 1993 EIR prepared for the proposed residential development and golf course at BMKV. This alternative feature was proposed in the 1993 EIR as a means of reducing peak flood stage at Highway 37 to 7 feet NGVD to provide an equivalent to the "ultimate channel" described in the Marin County flood control ordinance (Environmental Science Associates 1993).

This alternative feature would include widening Novato Creek from Highway 37 to San Pablo Bay, using a by-pass channel near Highway 37, and moving the existing north-side levees northward to expand the existing channel. In order to maintain the initial channel capacity in the by-pass channel and main channel, maintenance dredging would be required approximately every 10 years.

Flood control (outside of mitigation where significant adverse physical effects on flooding are identified) is not a purpose of the HWRP or the BMKV expansion. As described in chapter 4 of this document, the hydrologic and hydraulic analysis concluded that the 3 restoration alternatives selected for analysis in this document would not have a physical adverse effect on flooding, and that, even if it were determined that the project is inconsistent with the local flood zoning ordinance, this would not be a significant effect on the environment. A flood control feature is not necessary as mitigation because no significant physical adverse effect has been identified. This alternative feature would result in a significant change in the habitats within the lower portion of Novato Creek, which includes tidal salt marsh habitat that supports threatened and endangered species. Destruction or alteration of existing special-status species habitat in Novato Creek to build the bypass channel or to widen the existing channel is not necessary to conduct the restoration project and is counter to the goal of the project, which is to increase the amount of habitat for special-status species. In addition, NSD uses the fields north of Novato Creek as spray-irrigation fields for treated wastewater, and construction of new levees or a bypass channel could obstruct this use. Furthermore, these lands are not under the control or ownership of the project sponsors. Thus, after consideration, this alternative feature was dismissed from further analysis in this document.

Chapter 4
Affected Environment and Environmental Consequences

This chapter presents the affected environment and the environmental consequences and mitigation measures of the proposed BMKV expansion. The analysis of environmental consequences is based on the conceptual designs for wetland restoration presented in the previous chapter. Each of the restoration alternatives and the No-Action Alternative are analyzed in terms of the following resource topics.

- Geology, Soils, and Seismicity
- Surface-Water Hydrology and Tidal Hydraulics
- Water Quality
- Public Health
- Biological Resources
- Land Use and Public Utilities
- Hazardous Substances and Waste
- Transportation
- Air Quality
- Noise
- Cultural Resources
- Aesthetics

The focus of the analysis of environmental consequences is limited to the determination of whether the restoration alternatives would result in a "significant effect on the environment," according to CEQA, or would "significantly affect the quality of the human environment," according to NEPA.

CEQA defines a *significant effect on the environment* as "a substantial, or potentially substantial, adverse change in the environment" (PRC Div. 13 21068). CEQA Guideline 15382 describes *adverse change* as an "adverse change in any of the physical conditions within the area affected by the project

including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance."

CEQ NEPA Guideline 1508.14 defines the *human environment* as "the natural and physical environment and the relationship of people with that environment." *Significantly,* as used in NEPA, requires considerations of both context and intensity (CEQ NEPA Guideline 1508.27).

Specific significance threshold criteria that were used to evaluate the significance of potential effects of the proposed restoration alternatives are presented below in the discussion of each subject area.

Furthermore, the evaluation of the potential effects of the wetland restoration alternatives uses the existing conditions on the expansion site as the baseline condition on which potential impacts are measured against.

Geology, Soils, and Seismicity

Affected Environment

Data Sources

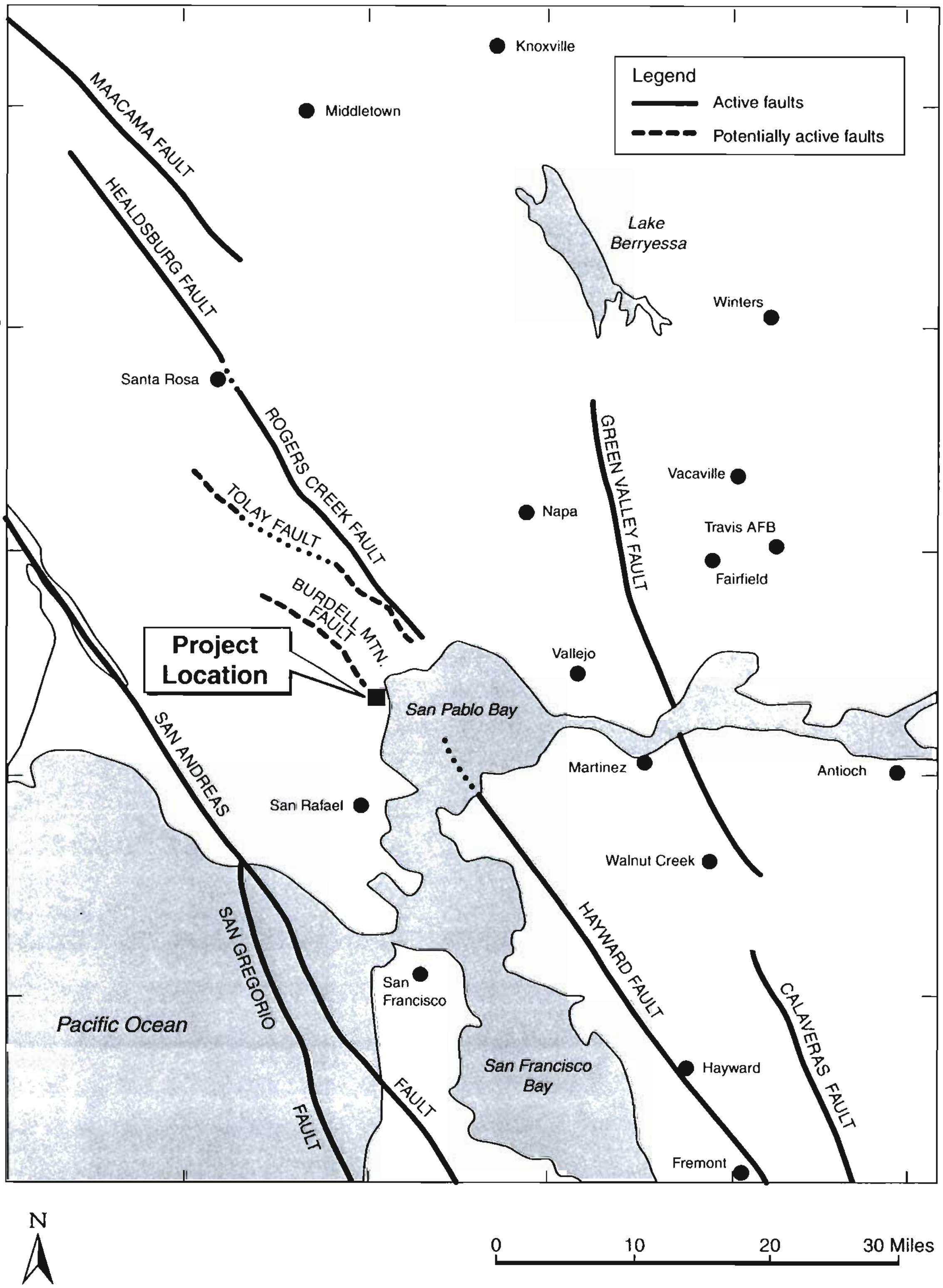
This section is based on previous geotechnical investigations and environmental studies performed within the BMKV site and neighboring areas. The primary sources of information used to prepare this section include the following documents.

- *Geotechnical Investigation Bel Marin Keys Unit 5* (Miller Pacific Engineering Group 1995)
- *Bel Marin Keys Unit V Final Environmental Impact Report/Environmental Impact Statement* (Environmental Science Associates 1993)

Regional Geology and Topography

The expansion site is located within California's geologically and seismically active Coast Ranges Geomorphic Province. The province is characterized by a series of northwest-trending faults, mountain ranges, and valleys (figure 4-1) (Environmental Science Associates 1993).

The expansion site consists of former mudflats and marshlands that constitute a portion of the nearly level Bay Plain geomorphic zone, which extends from the edge of San Pablo Bay to the foot of the hills located immediately west of the site. The construction of agricultural levees in 1892, and subsequent agricultural



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nhc northwest hydraulic consultants

Figure 4-1
Active and Potentially Active Faults in the Vicinity of the Bel Marin Keys Unit V Expansion Site

land drainage activities, caused the expansion site to settle to its current elevation of -4 to -5 feet National Geodetic Vertical Datum (NGVD) (Miller Pacific Engineering Group 1995).

The expansion site is underlain entirely by bay mud, which consists of soft, unconsolidated silty clays that typically exhibit low permeability, high compressibility, and low shear strength. The thickness of the bay mud deposits located beneath the project site ranges from 90 feet near San Pablo Bay to 20 feet near Pacheco Pond. Bay mud deposits in the expansion area are typically underlain by much stronger and less compressible soils and geologic deposits. The groundwater table beneath the expansion site typically resides from 2 to 4 feet below the ground surface but often nears the surface during the rainy season (Miller Pacific Engineering Group 1995).

Soils

According to the Soil Survey of Marin County (Kashiwagi 1985), the bay mud deposits that underlie the expansion site are overlain entirely by soils of the Reyes series. Soils of the Reyes series typically consist of slowly permeable clays and silty clays. The near-surface horizon of the Reyes soil at the expansion site is referred to as a "desiccated crust" by Miller Pacific Engineering Group (1995), apparently because their textural properties do not contrast significantly with those of the underlying bay mud deposits. The Reyes soils are more consolidated than underlying bay mud deposits but are still susceptible to settlement when dewatered or subjected to large static-fill loads (Miller Pacific Engineering Group 1995). Due to the fine texture of the Reyes soil and the low slope gradients that prevail at the expansion site, the hazard of soil erosion is slight.

Seismicity and Geologic Hazards

The expansion site is located in one of the most seismically active regions in the United States. The site's seismic setting is dominated by the Hayward fault to the southeast, the San Andreas fault to the west, and the Healdsburg–Rogers Creek fault to the northeast (figure 4-1). The maximum credible earthquake for each of these faults, measured in Richter scale magnitude (M), is as follows.

- Hayward fault—7.5 M
- San Andreas fault—8.3 M
- Healdsburg–Rogers Creek fault—7.2 M

Two smaller, potentially active faults are near the expansion site. A possible trace of the Burdell Mountain fault is mapped as extending toward and terminating north and west of the expansion site. Estimates differ regarding the date of the last displacement on the Burdell Mountain fault. It is generally

thought to have been active during the Quaternary period (the last 2.5 million years), and some evidence suggests that it may have been active during the Holocene epoch (the last 11,000 years) (Environmental Science Associates 1993). The Tolay fault also reaches to within 6.5 miles of the expansion site and may be active (Robert Bein, William Frost & Associates 1995).

The expansion site is likely to undergo ground shaking from a major earthquake. The U.S. Geological Survey (USGS) has estimated that there is a 67% probability that there will be 1 or more earthquakes of magnitude 7.0 or greater in the Bay Area in the next 30 years (Environmental Science Associates 1993).

Four major hazards are associated with earthquakes: surface fault rupture, ground shaking, ground failure, and inundation resulting from earthquake-generated waves (tsunamis or seiches).

Ground Shaking

Factors that would affect the intensity of ground shaking at the expansion site during an earthquake on a nearby fault include the following.

- Characteristics of the fault generating the earthquake
- Distance to the fault and earthquake hypocenter
- Earthquake magnitude
- Earthquake duration
- Site-specific geologic conditions (i.e., the nature of the geologic materials underlying the expansion site) (Miller Pacific Engineering Group 1995)

Unconsolidated materials tend to amplify ground shaking to a greater extent than bedrock. Accordingly, ground shaking during an earthquake would likely be more intense at the expansion site than in nearby areas underlain by bedrock.

Surface Fault Rupture

No active or potentially active faults are known to exist within the boundaries of the expansion site. In addition, the expansion site is not within an Alquist–Priolo Special Studies Zone, as designated by the California Division of Mines and Geology (Hart and Bryant 1997). Accordingly, the potential for surface fault rupture to occur at the expansion site is remote (Miller Pacific Engineering Group 1995).

Ground Failure

Ground-failure hazards of potential concern at the site include liquefaction, earthquake-induced settlement, and lurching. All of these processes involve the displacement of the ground surface resulting from a loss of strength or failure of the underlying materials because of ground shaking.

Liquefaction is the sudden loss of soil strength during strong ground shaking, which results in temporary fluid-like behavior of the affected soil materials. Liquefaction typically occurs in areas where groundwater is shallow and materials consist of clean, poorly consolidated, fine sands and silts. The Reyes soils and bay mud deposits that underlie the expansion site are not conducive to liquefaction because they do not contain substantial quantities of clean sands and silts (Miller Pacific Engineering Group 1995).

Ground shaking can also induce the settlement of loose, granular soils (i.e., clean sands and silts) located above the groundwater table. The Reyes soils and bay-mud deposits that underlie the expansion site consist of clays and silty clays rather than clean sands and silts. Thus, there is no potential for seismic settlement to occur at the expansion site (Miller Pacific Engineering Group 1995).

Lurching, or lurch cracking, is the cracking of the ground surface in soft, saturated material as a result of earthquake-induced ground shaking. Lurch cracking generally occurs along the edge of steep embankments where stiff soils (e.g., manufactured fill materials) are underlain by soft, compressible soils and geologic deposits (Miller Pacific Engineering Group 1995). Because the expansion site is underlain by soft, compressible bay-mud deposits, there is a potential for earthquake-induced lurch cracking to occur at the expansion site during an earthquake (Miller Pacific Engineering Group 1995).

Earthquake-Induced Inundation (Tsunamis and Seiches)

Tsunamis are sea waves produced by large-scale seismic events on the ocean floor. Seiches are earthquake-generated waves that form in enclosed water bodies, such as lakes or tidal marshes. Both can cause temporary inundation of upland areas. Due to its proximity to San Pablo Bay, there is a potential for the expansion site to be affected by tsunamis and seiches.

A tsunami with a 100-year recurrence interval (i.e., a 1% probability of occurrence in a given year) has an estimated run-up of 3 feet in the vicinity of the expansion site (Miller Pacific Engineering Group 1995). Likewise, a seiche generated in the vicinity of the expansion site is expected to be relatively small (less than a few feet) (Miller Pacific Engineering Group 1995). At its current elevation, the expansion site could be flooded by a tsunami in the event that the existing outboard levee fails or is overtopped (Environmental Science Associates 1993).

Environmental Consequences and Mitigation Measures

Approach and Methods

The following evaluation of potential geologic, seismic, and soil-related impacts associated with potential restoration was based on a review of geotechnical reports prepared for restoration and development in and immediately adjacent to the expansion site, the professional opinions rendered in these reports, and professional judgement.

Impact Mechanisms

The following restoration-related activities and natural processes could result in accelerated soil erosion; loss of nonrenewable soil or geological resources; personal injury; loss of life; or substantial damage to property, structures, or related improvements.

- Mass land grading and other forms of soil and vegetation disturbance
- Placement of fill materials on weak, compressible bay-mud deposits
- Earthquake-induced ground shaking

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding geology, soils, and seismicity, the proposed expansion was considered to result in a significant impact if it would

- result in a substantial change in topography or the destruction of any unique geologic formation or soil type;
- result in substantial soil erosion or the loss of nonrenewable soil resources;
- substantially degrade physical, chemical, or biological soil quality, and thereby degrade the ability of onsite soils to support sensitive habitats, such as wetlands;
- cause personal injury, loss of life, or substantial damage to property, structures, or site improvements as a result of *existing* geologic, seismic, or soil-related hazards; or
- cause personal injury, loss of life, or substantial damage to property, structures, or site improvements as the result of geologic, seismic, or soil-related hazards that would be *created* during the construction and operation of the restoration site.

Impacts and Mitigation Measures of No-Action Alternative

Impact G-1: Continued Land-Surface Settlement, Substantial Alteration of Natural Topography, and Loss of Soil Resources Capable of Supporting Sensitive Wetland Habitats

Under the No-Action Alternative, the expansion site would continue to be used for limited agricultural production. If the expansion site continued to be used for agricultural production, ground-surface settlement would likely continue to occur at its existing rate.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact G-2: Settlement of Proposed Levees, Uplands, Seasonal Wetlands, and Tidal Wetlands in Response to the Placement of Static Fill Loads

Implementation of Alternatives 1–3 would involve the construction of levees in the northwestern portion of the expansion site. Alternative 1 and Revised Alternative 2 would also involve the placement of dredged materials to create upland, seasonal wetland, and tidal wetland habitats. The Reyes clay soils and the bay-mud deposits that underlie the expansion site are compressible and therefore susceptible to settlement. The static loads imposed on these materials from the construction of levees and the placement of dredged materials would result in some degree of ground-surface settlement. The resulting settlement could be *uniform*, which would involve relatively uniform settlement over the affected area, or *differential*, which would involve unequal settlement over the affected area. Both types of settlement could affect the structural integrity of and/or reduce the level of flood protection provided by the levees. Additionally, ground-surface settlement resulting from the placement of dredged materials could temporarily inhibit the development of some of the proposed upland, seasonal wetland, and tidal wetland habitats.

The type (i.e., uniform or differential), ultimate amount, and rate of settlement that would occur would depend on the amount of fill placed, thickness of the underlying bay mud, and elevation of groundwater beneath the expansion site (Miller Pacific Engineering Group 1995). Uniform settlement is most likely to occur in areas where the thickness of both fill and underlying bay-mud deposits is relatively uniform (e.g., in the vicinity of the proposed tidal sub-basins). Conversely, differential settlement is most likely to occur in areas where there are significant differences in the thickness of fill and abrupt changes in the thickness of the underlying bay-mud deposits (e.g. near Pacheco Pond). The

ultimate amount of settlement would increase proportionately with thickness of fill and underlying bay-mud deposits. The rate of settlement would increase with the thickness of fill but decrease with the thickness of the underlying bay-mud deposits. Most settlement is expected to occur within the first 30–50 years after fill placement; settlement would slow appreciably after that time (Miller Pacific Engineering Group 1995; Jones & Stokes Associates 1996).

Detailed geotechnical investigations and analyses would be conducted during the final design stage of the proposed BMKV expansion to address the levee construction and dredged-material placement components of the selected restoration alternative with respect to settlement. These design-level investigations would identify and evaluate subsurface conditions encountered at the expansion site (e.g., thickness and compressibility of the bay-mud deposits) and describe how settlement would be mitigated and compensated for through the implementation of standard engineering methods. The specific techniques used to minimize and compensate for anticipated settlement would depend on the findings of the design-level geotechnical investigations, but could include:

- placement of additional fill above the intended finish grade of levees to compensate for anticipated settlement and sea-level rise;
- application of surcharge loads or other settlement acceleration techniques, such as the installation of wick drains; and
- uniform placement of fill during construction and avoidance of excessive fill placement.

Because the final design of the selected restoration alternative would be based on detailed subsurface investigations and would incorporate appropriate measures to adequately mitigate and/or compensate for anticipated settlement, this impact is considered less than significant.

Impact G-3: Potential Levee Slope Failure Resulting from the Low Shear Strength of Underlying Bay-Mud Deposits

Implementation of Alternatives 1–3 would involve the construction of levees in the northwestern portion of the expansion site. The shear strength of the bay-mud deposits on which these levees would be constructed varies with depth and prior loading conditions, but it is typically relatively low (Environmental Science Associates 1993; Miller Pacific Engineering Group 1995; Jones & Stokes Associates 1996). Although the shear strength of the bay-mud deposits would increase over time as they consolidate in response to the static fill loads imposed by the levees, the initially low strength of the bay-mud deposits could destabilize the levee embankments and possibly cause them to fail if the levees are not constructed correctly. Levee failure or destabilization would decrease the level of tidal flood protection provided by the proposed levees. Other factors that would influence the stability of the proposed levee embankments include the type and shear strength of the material used to construct the levees, height and

gradient of the levee embankments, and depth to which the proposed levees are inundated.

Detailed geotechnical investigations and analyses would be conducted during the final design of the selected restoration alternative to evaluate the engineering properties of the materials that would be used to construct the proposed levees and the bay-mud deposits on which the levees would be constructed. Based on the findings of these design-level investigations, standard engineering techniques would be incorporated into the final design and construction of the levees to minimize the potential for levee failure or destabilization. The specific techniques used to minimize the potential for levee failure and destabilization would depend on the findings of the design-level geotechnical investigations but could include:

- placement of levee fill in stages so that low strength bay-mud deposits are not overstressed;
- uniform placement of fill during construction and avoidance of excessive fill placement;
- application of surcharge loads or other settlement acceleration techniques, such as installation of wick drains, to increase the shear strength of underlying bay-mud deposits; and
- placement of stabilizing fill against the base of the proposed levees (permanent toe berms).

Because the final design of the selected alternative would be based on detailed subsurface investigations and would incorporate standard design and construction techniques to adequately minimize the potential for levee failure and destabilization, this impact is considered less than significant.

Impact G-4: Potential Short-Term Increase in Erosion and Sedimentation Rates during Construction

Many of the activities that would be conducted during the construction of Alternatives 1–3, such as the establishment and use of an equipment staging area, lowering of the levee adjacent to Novato Creek, and improvement of the existing levee located south of the BMK lagoon, would result in disturbances to soil and existing vegetation. Although the erosion hazard throughout the expansion area is slight under normal conditions, these and other construction-related disturbances would expose bare soil to erosion by water and wind and could increase erosion and sedimentation rates above pre-construction levels. However, a Storm Water Pollution Prevention Plan (SWPPP) would be prepared and implemented to address these and other construction-related erosion and sedimentation issues and to comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) general construction activity stormwater permit or other individual permit issued and administered by the

California State Water Resources Control Board. The SWPPP would prescribe temporary measures to control accelerated erosion and sedimentation in disturbed areas during construction, and permanent measures to control accelerated erosion and sedimentation once construction is complete. Implementation of the SWPPP would substantially reduce the potential for accelerated erosion and sedimentation to occur as a result of construction. Therefore this impact is considered less than significant.

Sedimentation issues associated with the placement of dredged material and levee construction are addressed in the *Water Quality* section of this chapter.

Impact G-5: Potential Damage to Proposed Levees Resulting from Earthquake-Induced Ground Shaking and Lurch Cracking

The expansion site is likely to experience ground shaking from a major earthquake in the next 70 years. Because the expansion site is underlain by unconsolidated bay-mud deposits, ground shaking likely would be more intense at the expansion site than in adjacent areas underlain by bedrock. Earthquake-induced ground shaking and associated lurch cracking could damage the levees proposed under Alternatives 1–3 and possibly increase the potential for tidal flooding in adjacent residential communities.

Detailed geotechnical investigations and analyses would be conducted during the final design of the selected restoration alternative to evaluate the engineering properties of the materials that would be used to construct the proposed levees and bay-mud deposits on which levees would be constructed. Based on the findings of these design-level investigations, standard engineering techniques would be incorporated into the final design and construction of the proposed levees to minimize the potential for lurch cracking and levee displacement during episodes of strong ground shaking. In addition, the conceptual restoration design already includes features that would minimize the potential for flooding in the event that the proposed flood control levees were damaged during an earthquake. These include (i) the installation of an outlet (culvert with flap gate) to Novato Creek and (ii) the improvement of the existing levee located between the expansion site and the BMK south lagoon (see figures 3-1, 3-5, and 3-8 in chapter 3 of this document).

Because the final restoration design would include specific design criteria to adequately minimize the potential for lurch cracking and levee displacement during an earthquake, and the conceptual designs for Alternatives 1–3 already incorporate measures to minimize the potential for flooding in the event that the proposed flood control levees are damaged during an earthquake, this impact is considered less than significant.

Impact G-6: Potential Exposure of Levees and Sensitive Wetlands to Tsunamis or Seiches

The expansion site is located adjacent to San Pablo Bay and would contain partially enclosed bodies of water (i.e., tidal marshes) if any of the restoration alternatives are constructed. As such, the expansion site could be subjected to a tsunami or a seiche during the lifetime of the proposed BMKV expansion. However, the projected run-up for seiches and tsunamis with 100-year recurrence intervals is relatively small (≤3 feet) (Miller Pacific Engineering Group 1995). The levees proposed under Alternatives 1–3 would be constructed sufficiently high to prevent them from being overtopped by a seiche- or tsunami-induced run-up of this magnitude. Likewise, a seiche or tsunami of this magnitude would likely have little permanent effect on the restored tidal marshes located on the outboard side of the proposed levees. Therefore, this impact is considered less than significant.

Surface-Water Hydrology and Tidal Hydraulics

This section discusses the physical effects of the restoration alternatives on surface-water hydrology and tidal hydraulics. Potential effects of the proposed BMKV expansion on flood overlay zoning and existing drainage agreements are also discussed in this section.

Affected Environment

Data Sources

The evaluation of hydrology is based on information contained in *Hydrologic and Hydraulic Modeling Assessment of Existing and Project Alternatives at Bel Marin Keys V* (Northwest Hydraulic Consultants 2002) included as appendix B of this document, as well as the following sources.

- *Hamilton Wetlands Conceptual Restoration Plan* (Woodward-Clyde 1998)
- *Flood and Drainage Baseline Study for Hamilton Army Airfield* (Bissell & Karn/Greiner 1993)
- *Perimeter Drainage Ditch Engineering Evaluation Report, BRAC Property Hamilton Army Airfield* (U.S. Army Corps of Engineers 1997)
- Hydrologic Analyses by Philip Williams & Associates, prepared in 1998 as supporting documentation for the Draft Hamilton Wetlands Conceptual Restoration Plan

The evaluation of flood zoning and drainage easements is based on the evaluation of hydrology and the language of the existing easements and flood zoning, which are summarized in appendix B and C, respectively, of this document.

Information presented in the tidal hydraulics section is based on the following sources.

- *Suspended Particle Transport and Circulation in San Francisco Bay: An Overview, in Estuarine Processes—Volume II* (Conomos and Peterson 1977)
- *Wind in California* (California Department of Water Resources 1978)
- *Sacramento–San Joaquin Delta Atlas* (California Department of Water Resources 1993)
- *Sediment Budget Study for San Francisco Bay* (U.S. Army Corps of Engineers 1992)

- Review of Model Plans for the John F. Baldwin Ship Channel Project (U.S. Army Corps of Engineers 1996c)
- Tidal benchmark data (Tide Gage 941-5252)

The datum referenced throughout this section is the **National Geodetic Vertical Datum of 1929** (NGVD) which is a fixed reference adopted as a standard geodetic datum for elevations determined by leveling. It was formerly called "Sea Level Datum of 1929" or "mean sea level." Although the datum was derived from the mean sea level at 26 tide stations, it does not necessarily represent local mean sea level at any particular place. (See NOAA Web site: http://www.ngs.noaa.gov/faq.shtml#WhatVD29VD88.) Another datum referenced in certain sources is **Mean sea level,** which is a local tidal datum. It is the arithmetic mean of hourly heights observed over the National Tidal Datum Epoch. Shorter series are specified in the name; for example, monthly mean sea level and yearly mean sea level. In order that they may be recovered when needed, such datums are referenced to fixed points known as benchmarks. (see http://il.water.usgs.gov/annrep_2001/misc/cddetion.htm). For this document, elevations (such as levees and water surface levels) are referenced to NGVD.

Topography

The BMKV site consists of former tidal marshlands that were historically diked and isolated from tidal action to permit agricultural use. Topographic relief in the area is low and gradients are gentle. A regional location map that indicates the location of the major surface-water and tidal channels in the vicinity of the BMKV site is shown in figure 4-2. Ground-surface elevations in the area are now as much as 6 feet below mean tide level (MTL). Subsidence has likely been an indirect result of diking for agricultural use. In the absence of natural tidal action, the shallow sediment column is no longer saturated; consequently, organic matter oxidizes and is reduced in volume, leading to settlement.

Perimeter levees separate the BMKV site from San Pablo Bay, Novato Creek, the BMK lagoon, Pacheco Pond, and the HAAF site. Table 4-1 shows levee-top elevations.

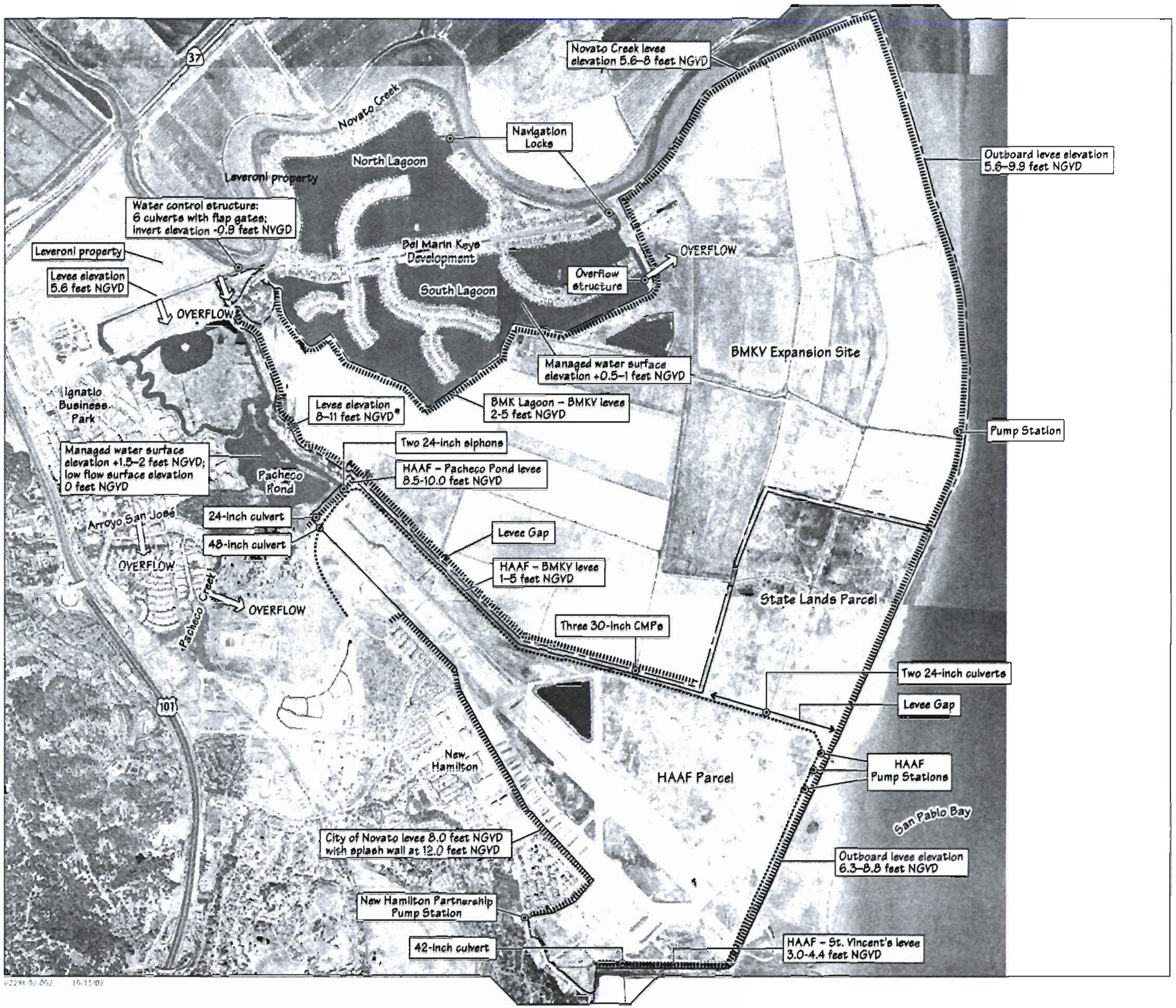

Figure 4-2
Hydrologic Setting at the Project Site

Legend

BMKV Expansion Boundary

Hamilton Wetland Restoration Project

Levee

Drainage Ditch

* With several low points around 6–7 feet NGVD.

N

1000 0 1000 2000 3000

Scale = 1:20,000
(1 inch = 1,666 feet)

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Table 4-1. Elevations of Levees Adjacent to BMKV Expansion Site

Levee Location	Approximate Levee-Top Elevation (Feet NGVD 29)
BMKV Site/San Pablo Bay	6–10
BMKV Site/Novato Creek	5–8
BMKV Site/BMK Lagoon	2–5
BMKV Site/Pacheco Pond	8–11 (with several low spots between 6' and 7' NGVD)
BMKV Site/HAAF Berm	1–5

A gap is present at the eastern end of the levee segment that separates the BMKV site from the HAAF site. The levee grade in that area has been lowered almost to the surrounding site grade.

Climate

The expansion site and the surrounding area are characterized by a Mediterranean climate with warm, dry summers and cool, wet winters (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). The climate is strongly influenced by conditions in San Francisco Bay and, to a lesser extent, the Pacific Ocean. July is typically the warmest month, with a mean daytime temperature of approximately 80° F. January is the coldest month, with a mean daytime temperature of approximately 54° F. Differences in minimum and maximum daily temperatures are approximately 30° F in the summer months and 15 to 20° F in the winter (U.S. Army Corps of Engineers 1987).

Precipitation near the expansion site ranges from approximately 22 to 30 inches per year, with 90% falling between the months of November and April (U.S. Army Corps of Engineers 1987), primarily in the form of rain. Even in the upper watersheds snowfall is rare, and snowmelt does not contribute significantly to runoff (San Francisco International Airport 2001).

Wind-direction frequency plots show a uniform directional distribution. The highest mean wind speeds originate from the northwest (10.4 miles per hour [mph]) and southeast (8.8 mph) (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Surface-Water Drainage Patterns

The expansion site is located in a watershed bounded by the hills of central and northern Marin County (a portion of the California Coast Ranges) to the west and San Pablo Bay to the east (figure 4-2). The upland areas have elevations of 1300–1600 feet NGVD 29 and support mixed open grasslands, oak woodlands,

and chaparral (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). The lowlands have elevations as low as several feet below MTL and consist of agricultural fields that were reclaimed from the Bay by levees in the late 1800s.

In the San Francisco Bay region, the permeability of both soils and underlying bedrock is typically low. As a result, infiltration rates are slow, runoff rates are correspondingly high and strongly dependent on precipitation, and base flow is poorly sustained. Most streams are ephemeral (San Francisco International Airport 2001).

Figure 4-2 shows the major surface-water drainage features on and near the expansion site. They are described in the following sections.

Pacheco Creek

Pacheco Creek drains a watershed of approximately 1.9 square miles. It originates 3 miles west of the HAAF site on Big Rock Ridge; crosses several roadways, including U.S. Highway 101, via culverts; and discharges into Pacheco Pond (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). Hydrologic studies completed for the Hamilton Airfield Wetland Restoration Plan estimated the 10- and 100-year discharges entering Pacheco Pond at 582 and 1,041 cubic feet per second (cfs), respectively (Philip Williams & Associates 1998).

The lower reach of Pacheco Creek is defined as the region downstream of the Northwest Pacific Railroad Bridge crossing. In this reach, overtopping due to downstream backwater effects is known to occur for flows smaller than the 10-year event (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998, Philip Williams & Associates 1998). When flooding occurs, overflow also affects the Las Robles mobile home area adjacent to the business park (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). Overflow was formerly directed toward Landfill 26 and back to Pacheco Pond over the Ammo Hill saddle (Philip Williams & Associates 1998). The U.S. Army constructed a berm around a portion of Landfill 26, the purpose of which is to protect the landfill from overflow from Pacheco Creek up to the level of the 100-year flood event (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). This change directed high flows back along the Pacheco Creek toward its confluence with Arroyo San Jose just north of Ammo Hill.

Arroyo San Jose

Arroyo San Jose drains a watershed of approximately 5.4 square miles. Like Pacheco Creek, Arroyo San Jose has its headwaters on Big Rock Ridge and discharges into Pacheco Pond. The 10- and 100-year discharges are 1,369 and

2,455 cfs, respectively (Philip Williams & Associates 1998). Arroyo San Jose accounts for approximately 75% of the inflow to Pacheco Pond (Philip Williams & Associates 1998).

Arroyo San Jose is expected to remain within its banks during floods as large as the 100-year event, with the exception of the lower reaches where high stages in Pacheco Pond can cause overtopping due to backwater effects (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

The project designers reviewed available historic maps and surveys for the project area going back to the mid 1850s. An 1863 U.S. Coast and Geodetic Survey based on an 1854 U.S. Coast and Geodetic Survey shows a fairly wide tidal marsh plain adjacent to San Pablo Bay and Novato Creek, but it does not extend far enough westward to show Arroyo San Jose (U.S. Coast and Geodetic Survey 1863). An 1860 map of Marin County shows Arroyo San Jose entering "salt marsh" in the approximate present-day location of Pacheco Pond and then joining a tidal channel that flows northward and then northeast to enter Novato Creek (Van Dorn 1860). At some point prior to 1914, the existing outlet channel (now just north of Bel Marin Keys Boulevard) was constructed, presumably as part of agricultural reclamation of nearby land (U.S. Geological Survey 1914). As of 1914, a natural channel was still present in a similar location to 1860, and was shown entering Novato Creek in a location north of the present-day railroad bridge at Highway 37 (U.S. Geological Survey 1914). At some point prior to 1942, it appears that the natural channel was eliminated, and all of the flow from Arroyo San Jose was rerouted to enter Novato Creek through the existing outlet just north of Headquarters Hill (U.S. Geological Survey 1942). Copies of relevant portions of the referenced maps are included in appendix B.

Pacheco Pond

Pacheco Pond, also known as Ignacio Reservoir, was constructed by the developer of the Ignacio Business Park and deeded to MCFCWCD as a detention basin for flows from Pacheco Creek and Arroyo San Jose. It also provides freshwater wetland and wildlife habitat. MCFCWCD and DFG jointly manage Pacheco Pond.

Pacheco Pond covers an area of approximately 120 acres and has an estimated flood storage volume of 866 acre-feet between an elevation of 0 and 7 feet NGVD 29. This volume was estimated by use of topographic data derived from a Light Detection and Ranging (LIDAR) survey conducted in 2000 (San Francisco International Airport 2001). Pacheco Pond discharges into Novato Creek via a leveed channel with an invert elevation of –0.9 feet NGVD 29, controlled by six 4-foot-by-4-foot flap gates. These gates are also known as the Leveroni tidegates.

Two 24-inch siphons were installed by the U.S. Air Force to provide an overflow from the pond reservoir onto the HAAF parcel. The siphons were designed to

prevent overtopping and damage to the airfield levee, but they are no longer operational (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

A 36-inch culvert connecting Pacheco Pond and the BMKV site was located in the levee between these two areas. The culvert, which is controlled by a slide gate, appears to be inoperable The outlet into the BMKV site is perched several feet above the adjacent ground and appears to have been abandoned for many years.

Water surface elevations in Pacheco Pond can be controlled by a sill at the upstream face of the Bel Marin Keys Boulevard culvert. The minimum pond elevation can be raised by inserting flashboards on the upstream side of the culvert. An operating agreement between MCFCWCD and DFG establishes the desired water-surface elevation in the pond water at 1.5 feet above mean sea level (MSL). The minimum pond water surface elevation is equivalent to the sill elevation of the culvert (approximately –0.9 feet NGVD 29). Flashboards were not in place during a site inspection completed in January 2002. At the time of the inspection, inflow to Pacheco Pond from Arroyo San Jose and Pacheco Creek was minimal, and the water-surface elevation in the pond was measured at approximately 0.0 feet NGVD 29 in January 2002 (Northwest Hydraulic Consultants 2002).

During high-flow events, the water level in Pacheco Pond may exceed the elevation of adjacent levees. The lowest point in the levees (elevation 5.6 feet NGVD 29) is north of the pond, adjacent to the Leveroni property. Overtopping has also been observed near the confluence of the outflow channel with Novato Creek, on the west side of the pond near Ignacio Business Park, further upstream at the Las Robles mobile home park, and along the westerly levee near Headquarters Hill (Philip Williams & Associates 1998; California State Coastal Conservancy and U.S. Army Corps of Engineers 1998.

Novato Creek

Novato Creek is the principal drainage in the vicinity of the expansion site and has an approximate total watershed area of 44 square miles (U.S. Army Corps of Engineers 1987). The Corps has computed 10- and 100-year discharges near the Highway 101 crossing of 3,420 cfs and 6,230 cfs, respectively (U.S. Army Corps of Engineers 1987), and recognizes an "ultimate flow" of 8,000 cfs at the mouth of Novato Creek. However, the lower channel and the railroad bridges downstream of Highway 101 and adjacent to Highway 37 constrict the flow, causing overtopping upstream of the lowest reach of Novato Creek and reducing the actual discharge in the lower reaches of the creek. The 8,000-cfs value in particular is unlikely to pertain to the reaches of Novato Creek adjacent to the BMKV site (Presidio Group 1996).

Recent modeling efforts have shown that the tidal influence extends upstream of Highway 101 to the City of Novato during flows greater than the 10-year event (Philip Williams & Associates 1998). During storm periods, the maximum water surface elevation observed at the Highway 37 crossing was approximately 7 feet NGVD 29 (Philip Williams & Associates 1998).

Top-of-levee surveys completed in 1996 indicate that the levee crest between Novato Creek and the BMKV site dips to an elevation of approximately 5.6 feet, NGVD 29, at a point approximately 1000 feet downstream from the BMK south lagoon navigation lock (Jones & Stokes 1996). Overtopping of this levee was observed by BMK residents in the February 1998 flood event.

Downstream of Highway 101, the geometry of Novato Creek is characteristic of tidally influenced channels throughout San Francisco Bay and is composed of a consolidated bay mud main channel with tidal salt marsh benches. The slope of the lower channel is relatively mild, with a general longitudinal slope of 0.002 feet per foot between Highway 101 and Diablo Avenue to approximately 0.0001 feet per foot near the mouth. Novato Creek transitions from channel-control to tidal-control within this reach, as the slope of the creek reduces and the creek elevations come within San Pablo Bay tidal range. Tidal effects from San Pablo Bay become apparent and influence the stage of the creek, as the creek stage rises and falls with the tidal stage in San Pablo Bay. The location of the transition point from channel-control to tidal-control varies with the magnitude of terrestrial inflows and tide stage characteristics. Channel conveyance and thus discharge capacity in lower Novato Creek is directly related to the tide level. Since both the tide stage and inflows to Novato Creek vary with time, the channel conveyance also varies with time.

From the Northwestern Pacific Railroad (NPRR) bridge east of Highway 101, the existing Novato Creek channel is relatively narrow. Using HEC-2, a steady-state hydraulic model developed by the Corps, the Federal Emergency Management Agency (FEMA) calculated a maximum channel conveyance capacity downstream of the NPRR bridge of 2,500 cfs (Federal Emergency Management Agency 1989). It is worth noting that this is significantly less than the effective 10-year peak discharge of 3,420 cfs published in the City of Novato flood insurance study (FIS) (Federal Emergency Management Agency 1989). When flows exceed channel capacity, over-bank flow over the surrounding levees occurs starting with the low points of surrounding levees. This over-bank flow has occurred previously into the agricultural areas between the NPRR bridge and Highway 37, as well as in the agricultural areas between Highway 37 and the mouth of the creek.

The 1984 City of Novato Flood Insurance Rate Map (FIRM) published by FEMA indicates a nearly flat water surface coincident with the peak 100-year tidal stage in the lower reach of Novato Creek, which reveals the dominance of tidal flooding over terrestrial flooding in Novato Creek downstream of Highway 37 for the 1% annual exceedance probability (100-year recurrence interval) flood.

Tidal cycles during storm events reduce the available channel capacity to drain riverine flows, which exacerbates and increases flood stage in the creek channel.

Over the last 2 centuries, hydrologic conditions in the Novato Creek watershed below Highway 37 have varied dramatically due to changes in land use practices and engineered modifications to the land surface. These modifications include the construction of flood protection levees, the development of Pacheco Pond as a flood detention system, and the rerouting of drainage channels and installation of flap gates on Simmons Slough and Pacheco Pond. This has decreased the tidal prism of lower Novato Creek significantly and has resulted in accretion of the channel. Comparisons of recent topographic and bathymetric surveys (Towill 1971 and 1996) to survey mapping from the 1800's (U.S. Coast and Geodetic Survey 1863, 1887,1889, and 1899) show dramatic reductions in channel width. The reduction in channel size due to accretion has decreased the flood capacity of the system and has proved undesirable for navigation. The creek is constantly evolving toward a smaller width and depth consistent with the reduced tidal prism. Actions to counter the effects of channel accretion include the periodic surveying and raising of levees along the north side of Novato Creek from Highway 37 to the mouth of the creek, and dredging of Novato Creek downstream of its confluence with Pacheco Pond.

Bel Marin Keys Development

The BMK development is located adjacent to the northwest boundary of the expansion site. BMK is a waterfront residential community with 2 internal constructed lagoons that offer access to Novato Creek though a system of locks. The BMK community uses Novato Creek for boat access to San Pablo Bay and relies on tidal changes in water level to periodically exchange flow between the BMK lagoons and San Pablo Bay. Storm drainage to the lagoons is aggravated by coincident high Novato Creek stages, caused either by high San Pablo Bay tides or high Novato Creek discharge, with high amounts of local precipitation over the BMK development. High water stages in Novato Creek due to high tides and/or high flows from the Novato Creek watershed have resulted in overtopping of the north lagoon lock tainter gates and low portions of the levee adjacent to the south lagoon lock (Tweed pers. comm.).

Water level is managed at 2 feet NGVD 29 in the north lagoon and 0.5–1 foot NGVD 29 in the south lagoon (Presidio Group 1996). Stormwater is discharged to Novato Creek via the boat access lock. Discharge into Novato Creek is limited by stage in the creek; during high-flow periods, runoff is impounded in the lagoons until flow recedes (Presidio Group1996).

Stormwater from the south lagoon can also be discharged onto BMKV via culverts in the levee on the eastern edge of the south lagoon. In 1997, the former owner of the BMKV property granted the BMK Community Services District (CSD) the right to construct, maintain, and repair an emergency spillway on the existing levee, the purpose of which is to relieve high water in the lagoon

surrounding Units III and IV of the BMK subdivision. This agreement also granted the right to discharge water onto a 3-acre portion of one of the BMKV parcels p from the lagoon when the lagoon and Novato Creek reach a level of 1.5 feet NGVD (see appendix E). At present, the conveyance structure for flow from the BMKV south lagoon to the adjacent part of the BMKV property consists of a weir and three 12-inch culverts. The low point on the BMKV south lagoon/BMKV levee is approximately 2 feet NGVD, so it is also possible for flow to overtop the south lagoon levee and flow onto BMKV. Most of the south lagoon/BMKV levee elevation is approximately 5 feet NGVD.

The BMK CSD periodically dredges the lagoons to remove sediment that settles in the lagoons. This dredging is in addition to the aforementioned dredging of the Novato Creek channel for navigation. The BMK CSD also periodically (approximately once to twice monthly) flushes the lagoons both to maintain water quality in the lagoons and to promote scour in the lower Novato Creek channel to favor navigation (Krone 1989) The flushing procedure, while promoting scour, has not eliminated the need for maintenance dredging, and the BMK CSD is presently planning for an upcoming dredging event.

Hamilton Army Airfield

The former HAAF property is located south of the BMKV site. The HAAF site receives flood overflows from Pacheco Creek via 48- and 24-inch flap gates that serve the Landfill 26, Ammo Hill, and POL Hill areas. However, prior to 1999, the Army completed construction of a berm around a portion of Landfill 26 to protect the landfill from overflow from Pacheco Creek up to the 100-year flood. (HAAF BRAC Environmental Office 2001.) Historically, HAAF also received overflows from Pacheco Pond via 2 slide-gated siphons. These siphons are no longer operational (Philip Williams & Associates 1998). Flood overflows also enter the HAAF site from the BMKV parcel through a levee gap approximately 2,000 feet southeast of the HAAF site's northwest corner.

Conceptual design for the HAAF tidal wetland restoration feasibility study (U.S. Army Corps of Engineers 1998) suggested that the connection between HAAF and Pacheco Pond may change. The specific design of any modified drainage between Pacheco Pond and HAAF has not been determined at this time. No modifications to the connection between Pacheco Pond and HAAF are proposed as part of the BMKV expansion.

Tides

Tides in San Pablo Bay follow a mixed semidiurnal cycle, with 2 high tides of unequal elevation and 2 low tides of unequal elevation per day. Average high tide elevation values are referred to as mean higher high water (MHHW) and mean high water (MHW). Similarly, low tide peaks are referred to as mean low water (MLW) and mean lower low water (MLLW). Events such as storm high

tides that exceed the elevation of MHHW are referred to as extreme high tide (EHT).

Because of geographic and hydrodynamic complexities, tidal characteristics, including the elevations of average high, low, and mean tides, differ substantially throughout the San Francisco Bay–San Pablo Bay system. Tide cycles in San Pablo Bay typically lag behind those at the Golden Gate by as much as 75 minutes (U.S. Army Corps of Engineers 1996). However, within San Pablo Bay itself, comparison of tide levels within Novato Creek and at the mouth of the Petaluma River indicates that the lag time is negligible between these sites (Philip Williams & Associates 1998).

Table 4-2 shows statistical tidal information for the expansion site, obtained from measurements made by the National Oceanic & Atmospheric Administration/National Ocean Survey (NOAA/NOS) at the mouth of the Petaluma River (Tide Gage #941 5252) (NOAA/NOS 2002). Table 4-2 also shows the expected elevation of a 100-year tide in San Pablo Bay. The 100-year tide represents a tide that has a 1-in-100 (or 1%) chance of occurring in any given year.

Table 4-2. Tide Information from the Petaluma River Entrance

Tide Level	Feet above MLLW Datum	Feet above NGVD 29 Datum
100-Year Event (SF COE)[1]	9.13	6.50
MHHW[2]	6.06	3.43
MHW[2]	5.49	2.86
MTL[2]	3.24	0.61
NGVD 1929[2]	2.63	0.00
MLW[2]	1.00	-1.63
MLLW[2]	0.00	-2.63

Note: datums do not take into account sea-level rise or wave runup.

Sources:
[1] U.S. Army Corps of Engineers 1984
[2] NOAA/NOS 2002

Tide data recently collected by San Francisco International Airport's Airfield Development Engineering Consultant (ADEC) (2000) at the mouth of the Petaluma River correspond closely to the NOAA/NOS data shown in table 4-2. The ADEC data consist of water surface measurements taken at 10-minute intervals over a 30-day period from June 15, 2001 to July 15, 2001. The MHW computed from the ADEC data is 0.14 foot below the value reported by NOAA;

the MLW computed from the ADEC data is 0.07 foot above the value reported by NOAA.

Sediment Budget

The sediment budget in the San Francisco Bay–San Pablo Bay system is a key factor in restoration design because it relies on natural delivery of sediment to transform the basin created by restoration efforts into a functioning, mature marshland over time. The fine-sediment fraction (suspended load and fine bed load) is particularly important because it provides the primary sedimentary building blocks for naturally evolving tidal marsh regimes. The following sections provide additional information on sediment loading in the Bay system, with a focus on the fine (suspended load) fraction.

Overview of Suspended-Sediment Loading in the San Francisco Bay Estuary

Like salinity, suspended-sediment concentration is controlled by a balance of factors. Important influences on suspended-sediment loading include wind speed and direction (i.e., the magnitude of wind-driven waves and strength of wave currents), freshwater influx, and tidal currents (Northwest Hydraulic Consultants 2001). Freshwater influx shows a strong seasonal variation, with a peak during the winter (November–April) rainy season; land-derived sediment loading shows a corresponding peak in the winter. Tidal currents vary on a semi-monthly basis from neap tides to spring tides, with the greatest sediment mobility at spring tides.

Throughout the year, suspended-sediment concentrations are generally highest in the North Bay region and at the southern end of the Bay. USGS data show average concentrations of approximately 80–150 milligram/liter (mg/l) in San Pablo Bay for water years 1997 and 1998 (USGS 1999 and USGS 2000). Sediment concentrations are typically lower in the central portion of the Bay (Northwest Hydraulic Consultants 2001).

Many of the North Bay's sloughs are fed by relatively small creeks. Measured sediment concentrations in these sloughs range from 41 to 386 mg/l and typically decrease with increasing distance from San Pablo Bay (Warner and Schoellhammer 1999, Buchanan and Ruhl 2000) because the Bay is their primary source of sediment. By contrast, the larger Petaluma River system carries a substantial suspended-sediment load because of its larger watershed. Sedimentation rates at locations on the margin of San Pablo Bay near the river mouth (e.g., Bel Marin Keys, Port Sonoma Marina, and Petaluma Marsh) are as much as 0.5–1.3 feet per year (U.S. Army Corps of Engineers 1998).

Flood Overlay Zoning

The Marin County Zoning map currently designates an 8-acre portion of the BMKV site along Novato Creek as an F-1 (primary floodway) overlay zone, with the remainder of the site designated as an F-2 (secondary floodway) overlay zone (see figure 4-3). A large portion of the surrounding areas in the lower Novato Creek watershed are also designated F-2 (see figure 4-4).

The F-1-designated zone is north of the northern levee of the site and on a small area in the northwestern corner of the site that faces Novato Creek. The purpose of the F-1 zone is to protect life and property within the designated zone and to prevent random, uncontrolled development from impeding passage of floodwaters and increasing flooding. No dredging, filling, or levee or dike construction is permitted within F-1 zones if it would increase the water-surface level or impede the flow of water within the zone.

The F-2-designated zone covers the remainder of the BMKV site. The purpose of the F-2 zone is to protect life and property and to prevent random, uncontrolled development from increasing flooding by decreasing the capacity of secondary floodplains to receive overflow floodwaters. No buildings, dredging, filling, or levee or dike construction is permitted within F-2 zones if it would reduce or eliminate the ponding capacity of the land within the F-2 zone by more than 25%. If the ultimate flood control channel improvements (described below) were made to Novato Creek, as defined by the MCFCWCD, or if an alternate method of providing flood control facilities for the zone, equal in capacity to the ultimate channel improvements, was established, then full use of the site would be allowed. The ultimate channel improvements consist of constructing a specified channel along Novato Creek from Highway 101 to San Pablo Bay that is designed to contain approximate 100-year flood events within the channel.

Drainage Agreements and Easements

The BMKV site is subject to 3 drainage agreements and easements relevant to the expansion (see figure 4-4).

The BMK Unit IV development is an approximately 100-acre area located in the southwest portion of the larger BMK residential development area. To facilitate the development of BMK Unit IV within the F-2 zone, a drainage agreement was recorded in 1980 that allowed the development of BMK IV to proceed, provided that a 300-acre area (Area 1 on figure 4-4) was preserved for flood protection purposes on BMKV. The agreement was between the former owner of the BMKV property and MCFCWCD, and specified that the owner of the 300-acre area on BMKV could not fill or otherwise prevent flood-water ponding and could not use the area in a manner that would cause additional flooding to other properties in the vicinity. Provisions of this agreement remain in full force until Novato Creek ultimate channel improvements occur or equivalent measures are implemented.

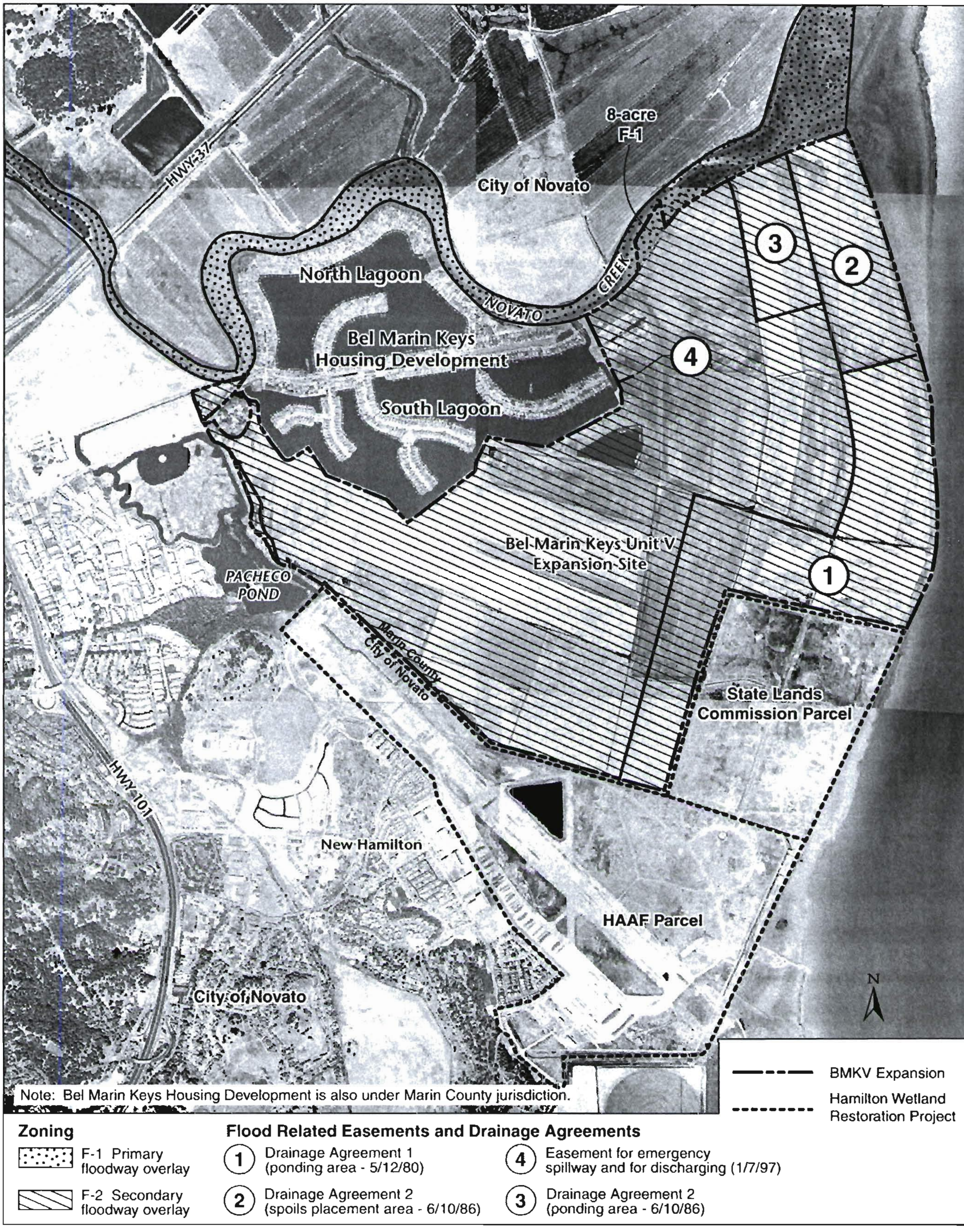

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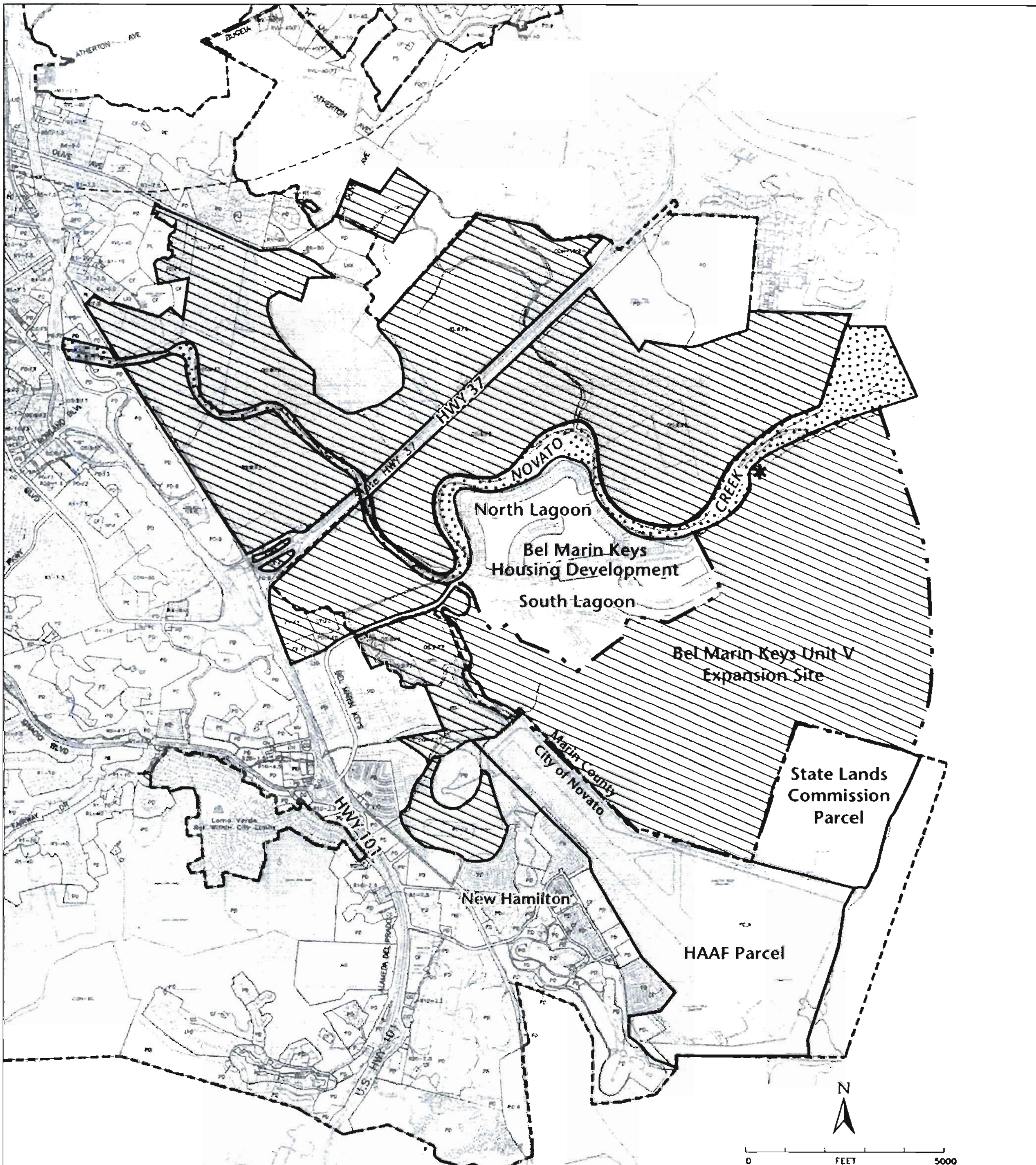
Figure 4-3
Flood Zoning Overlays, Flood Related Easements and Drainage Agreements



✱ Note: Along Novato Creek, there are approximately 8 acres of the Bel Marin Keys Unit V site within F1 zoning.

Zoning

F-1 Primary floodway overlay (along Novato Creek)

F-2 Secondary floodway overlay

Sources: City of Novato, Novato Zoning Map, April 2001
Marin County, Lower Novato Creek Floodway Zones (F-1 and F-2 Districts), March 1973

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Figure 4-4
Flood Zoning in the Vicinity of the Bel Marin Keys Unit V Expansion Site

A second drainage agreement was established in 1986 to facilitate the placement of dredged materials by BMK CSD on several fallow fields in the northeast corner of BMKV (Area 2 on figure 4-4). This agreement was between BMK CSD, MCFCWCD, and the owner of the BMKV parcel, and required the owner of BMKV to maintain a 70.2-acre area (Area 3 on figure 4-4) for ponding purposes to compensate for the loss of ponding capacity in the dredged material placement area. Other areas can substitute for Area 3 if the replacement ponding area has a ponding volume as great or greater than that of Area 3; the substitution ponding area won't flood other property in the area; and MCFCWCD agrees. The agreement conditions can also be lifted if the owner moves all or part of the dredged material fill to another location, which would release the obligation to retain Area 3 for flood-water ponding as long as the owner provided an engineered plan that is satisfactory to MCFCWCD. Provision of this second agreement remains in force until the Novato Creek ultimate channel improvements occur, equivalent storage is provided, or all government agencies have issued permits for the development of parcels adjacent to the dredged material area and Area 3.

In 1997, the owner of the BMKV property provided an easement (Marin County Recorders Serial No. 97-000917) to BMK CSD to construct, maintain, and repair an emergency spillway on the south lagoon levee (location 4 on figure 4-4). The purpose of this emergency spillway is to relieve high water in the south lagoon surrounding the BMK subdivision. The easement granted the right to discharge overflow water from the south lagoon to a 3.0-acre portion of Parcel 157-172-07, when the lagoon and Novato Creek reach a level of 1.5 feet NGVD. The easement provides for removal of the easement if a project on the BMKV property includes flood control measures, such as levees of sufficient height, to contain the high water in the lagoons surrounding Units III and IV of the BMK subdivision. It should be noted that the easement makes no mention of and is unrelated to the other 2 easements (for 300 acres and 70 acres) mentioned above.

Flood Zone Mapping and Flood Insurance

This section summarizes the National Flood Insurance Program (NFIP) and flood mapping of the project area and the adjacent BMK residential area. This section has been added since the Draft SEIR/EIS because a number of commenters asked how the proposed project related to flood zone mapping and flood insurance rates.

FEMA manages the NFIP. There are 3 components of the NFIP: (1) flood hazard mapping, (2) floodplain management, and (3) flood insurance. Engineering studies, referred to as FISs, are conducted to characterize flooding risks within a community by identification of base flood elevations (BFE). The BFEs are the elevations of the 100-year storm event (referred to as the base flood) identified in the FIS. The results of the FIS are used to identify special flood hazard areas (SFHA), which are areas that the FIS indicated would be

inundated by the 100-year storm event. These areas are then identified in FIRMs.

Communities participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Marin County (within which the BMKV site and the BMK community are located) is a participant in the NFIP with MCFCWCD as the local community agency responsible for floodplain management. To get secured financing to buy, build, or improve structures in an SFHA, homeowners are required to purchase flood insurance. Flood insurance is not mandatory outside the SFHA. Flood insurance rates are determined based on the risk zone identified on the FIRMs.

FEMA conducted a FIS for the unincorporated parts of Marin County, including the BMKV site and the BMK residential area in 1972, published a flood hazard boundary map in 1977 and published a FIRM in 1982 (FEMA 1982 and 1986). FEMA completed an additional FIS for the unincorporated parts of Marin County in 1986, but did not update the FIRM for the BMKV site (FEMA 1986). FEMA also completed an FIS for the City of Novato (including areas adjacent to the BMKV site and the BMK residential area) and published associated FIRMs in 1989 (FEMA 1989a and 1989b). The FIRMs for the relevant parts of unincorporated Marin County (Panels 0601730259 and 0601730300) identify the BMKV site as within the A1 zone (BFE of 6 feet NGVD) (Federal Emergency Management Agency 1982 and1989b). The BMK residential area is identified as located within the C zone [which is not a flood hazard zone], with the exception of a low-lying area along Novato Creek and the BMK lagoons, which are located within the A1 zone (BFE of 6 feet NGVD) (FEMA 1982). The FIRM for the City of Novato (parcel 0601780005) shows Pacheco Pond as within the AE zone (BFE of 8 feet NGVD) (FEMA 1989b). The BMKV site, the BMK lagoons, and Pacheco Pond are mapped as within SFHAs; the BMK residential area and Headquarters Hill are not. Flood insurance is available for BMK residences within the C zone, but it is not required by regulation in this zone. Copies of relevant portions of the local FIRMS are included in appendix C.

Local floodplain management regulations are required to meet the minimum standards found in FEMA regulations, which are located in 44 Code of Federal Regulations (CFR) Section 60. As identified in 44 CFR Section 60.12, for state-owned properties in special hazard areas, the state is required to either (1) comply with the floodplain management requirements of a local community within which the state-owned properties are located, or (2) establish and enforce floodplain management regulations that satisfy the minimum criteria found in FEMA regulations (44 CFR 60.3, 60.4, and 60.5). Floodplain management criteria for flood-prone areas are presented in 44 CFR Section 60.3. In Section 60.3(d)(3), the FEMA regulations identify that construction (including fill) should be prohibited in the regulatory floodway unless it is demonstrated through hydrologic/hydraulic studies that the proposed encroachment would not increase flood levels.

Environmental Consequences and Mitigation Measures

Approach and Methods

Hydrologic resources and surface-water drainage patterns in the expansion area have been documented extensively in previous work (Northwest Hydraulic Consultants 2002, U.S. Army Corps of Engineers 1989 and 1997, Bissell & Karn/Greiner 1993, unpublished U.S. Army Corps of Engineers data, Woodward-Clyde 1998, and associated background information). The potential environmental consequences of the restoration alternatives on hydrological resources have been evaluated primarily through review and analysis of available information. Based on an understanding of present hydrologic conditions, the potential impact mechanisms were identified. Potential impacts were then identified based on these impact mechanisms, and additional technical analysis was conducted where required to quantify or mitigate impacts associated with the proposed BMKV expansion.

To assess the impacts of tidal wetland restoration on the hydrology of the site, Northwest Hydraulics Consultants completed hydrologic and hydraulic modeling studies that assessed the effects of proposed expansion activities, such as Pacheco Pond and tidal wetland modifications, on flooding conditions along Novato Creek and Pacheco Pond. These studies were based on a review of hydrological studies of the Novato Creek and Pacheco Pond watersheds. Existing and potential future site conditions that affect the drainage and flooding characteristics were identified. Representative flood hydrographs and tidal stage characteristics were determined and used for computing flood stage and discharge conditions in the study area. To quantify the changes in flood stage and discharge magnitude resulting from coincident terrestrial and tidal flood conditions, a one-dimensional, unsteady flow model of the Novato Creek and Pacheco Pond system was developed. The modeling approach and results are discussed in greater detail in appendix B.

Potential impacts on the tidal hydraulic regime and morphology of San Pablo Bay and its environs were determined by comparing the magnitude of the relevant tidal hydraulic parameters under existing conditions with the expected magnitude of the tidal hydraulic parameters after implementation of the various restoration alternatives.

Effects of the proposed BMKV expansion on flood overlay zoning and existing drainage agreements and on flood mapping and flood insurance are also discussed separately in this section.

Impacts to hydrology are identified as Impact HYD-#; impacts to tidal hydraulics are identified as Impact TH-#.

Impact Mechanisms

Hydrology

The following types of activities and processes associated with implementation of the restoration alternatives could result in changes in flooding and surface-water drainage in the vicinity of the expansion area.

Conversion of Existing Diked Agricultural Fields to Tidal Marsh

The restoration alternatives would convert existing diked lowlands in the expansion area to tidal wetland. The restored tidal wetland area would be subject to the tidal elevations characteristic of San Pablo Bay. Outboard levees along San Pablo Bay and Novato Creek would be breached and/or lowered to facilitate tidal wetland creation and tidal flows. The impact mechanisms for the proposed BMKV expansion include the effects of placing fill on existing drainage facilities for adjacent property and the effects of opening formerly diked areas to tidal flow.

Modification of Pacheco Pond and Pacheco Pond Outlet Facilities

The restoration alternatives would enlarge the dimensions of Pacheco Pond and/or provide for overflow of the pond to a seasonal wetland area. A new pond outlet would be constructed to allow discharge from Pacheco Pond to flow to either the tidal marsh restoration area (Alternatives 1 and 3) or the seasonal marsh restoration area (Revised Alternative 2) through a conveyance structure. The impact mechanisms for the proposed BMKV expansion include the effects on altered flood-storage characteristics of Pacheco Pond and changes in pond drainage conditions no longer influenced by water surface stage conditions within Novato Creek.

Pacheco Pond is owned by MCFCWCD and is operated under a joint agreement between DFG and MCFCWCD (Marin County Flood Control and Water Conservation District and California Department of Fish and Game 1980). As described in chapter 3, as part of the BMKV expansion, the Corps, Conservancy or their successors, in cooperation with MCFCWCD and DFG, would develop a new water management plan for Pacheco Pond to continue the purposes of flood control and wildlife habitat conservation for which the pond was built. Potential diversion of some or all of the discharge from Pacheco Pond in the wet season would potentially change flow and stage conditions within Novato Creek (see discussion in the impact analysis below). Responsibilities for maintenance of the Pacheco Pond facilities and outlet structures would be determined as part of the development of a new water management plan.

Tidal Hydraulics

The following types of activities and processes associated with implementation of the restoration alternatives could result in changes in tidal hydraulic

circulation or morphologic processes in Novato Creek, San Pablo Bay, or the restored tidal wetlands in the expansion area.

Tidal and Residual Circulation in San Pablo Bay

Creation of an additional tidal prism on the western shoreline of San Pablo Bay would induce tidal currents into and out of the tidal prism of the restored tidal wetland. This action could alter circulation patterns within San Pablo Bay.

Morphology of San Pablo Bay Shoreline and Novato Creek

The proposed BMKV expansion would involve construction of tidal outlet channels through the existing outboard salt marsh and mudflats. Additional morphologic adjustments and changes within San Pablo Bay and Novato Creek could develop over time.

San Pablo Bay Sediment Budget

The proposed BMKV expansion is designed to trap suspended sediment from San Pablo Bay and Novato Creek. Sediment deposition within the restored wetlands may affect the overall sediment budget and existing sediment deposition patterns within San Pablo Bay.

Tidal and Residual Circulation in Restored Tidal Wetlands

The proposed BMKV expansion would create tidal circulation and inundation on properties that are presently protected by levees and drained by the existing HAAF pump stations and perimeter drainage ditch.

Internal Peninsulas and Perimeter Levees

The proposed BMKV expansion would create tidal currents adjacent to the internal peninsulas and the expansion site perimeter levee. Tidal inundation would allow for wind-wave action on these structures that could induce erosion or morphologic change over time.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding surface hydrology, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- substantially alter drainage patterns, flow rates, or volumes;
- increase the risk of flood peaks or volumes that would damage infrastructure or property or endanger public safety;
- result in hydrologic changes that could adversely affect existing or planned biological communities;
- result in the need for new drainage facilities and capital expenditures; or
- increase the potential for erosion or sediment deposition.

Regarding tidal hydraulics, the proposed expansion was identified as resulting in a significant impacts on the environment if it would

- alter the magnitude and direction of tidal circulation outside the immediate zone of subtidal and outboard marsh channels constructed for the project;
- alter the large-scale morphology of mudflats and subtidal channels outside the immediate zone of subtidal and outboard marsh channels constructed for the project;
- cause erosion of the perimeter levees, thus increasing the risk of tidal flooding on adjacent properties;
- induce or aggravate erosion of the existing outboard salt marsh;
- cause insufficient sediment deposition within the tidal marsh to develop morphologically as proposed; or
- cause long-term persistence of internal peninsulas.

In addition to these criteria, the consistency of the restoration alternatives and existing flood zoning designations and drainage agreements were considered when evaluating the significance of potential project effects on hydrology.

Impacts and Mitigation Measures of No-Action Alternative

Maintaining the BMKV parcel in its present condition would result in no impacts on the surface-water hydrology of San Pablo Bay and Novato Creek. The Conservancy would continue to maintain the property in caretaker status. Operation and maintenance of Pacheco Pond and its appurtenances and the interior drainage system of the BMKV site would continue. The existing surface-water drainage characteristics of Pacheco Pond, Novato Creek, the BMK community, and the BMKV site would be unaffected.

Maintaining the BMKV site in its present condition would result in no impacts on the tidal hydraulic environments of San Pablo Bay and Novato Creek. The existing outboard tidal marshes, mudflats, and subtidal channels of San Pablo Bay would be unaffected.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact HYD-1: Potential for Change in Peak Stage in Pacheco Pond

As part of the restoration alternatives, the physical dimensions of Pacheco Pond would be enlarged and provide additional storage capacity of the Pond. The restoration alternatives also entail the construction of a new connection between Pacheco Pond and the BMKV site, and the potential diversion of some or all flow from the existing outlet of Pacheco Pond to Novato Creek to the BMKV site. Diverting the flow to BMKV would reduce Pacheco Pond stages during flood events by eliminating constraints on existing Pacheco Pond drainage imposed by high Novato Creek stages that occur during coincident flooding events. High Novato Creek stages control Pacheco Pond flap-gate (also known as the Leveroni tidegate) operations under existing conditions, limiting the duration and magnitude of discharges from the gates. Under Alternatives 1 and 3, the enlarged Pacheco Pond would be directly connected to the restored tidal marsh and San Pablo Bay. Therefore, operation of the new flap gates would be constrained only by San Pablo Bay tide stage and not by coincident Novato Creek and tidal flooding conditions. Revised Alternative 2 proposes an overflow connection between an expanded Pacheco Pond and a seasonal wetland basin. The expanded pond and the seasonal wetland basin would provide additional flood storage capacity for the Pacheco Pond system and ultimately discharge directly to the restored tidal marsh and San Pablo Bay.

Under Alternatives 1 and 3, Pacheco Pond would be expanded to a capacity of approximately 1,241 acre-ft (above 0-ft, NGVD 29), with flow diverted to restored tidal marsh through a flap-gated culvert structurewith an invert of 1.5' NGVD. This would be an increase of 375 acre-ft above existing capacity. Under Revised Alternative 2, Pacheco Pond would be expanded through the addition of an expansion of the pond/emergent wetland (33 acres in total) with a capacity (below 7 ' NGVD) of about 175 acre-ft. A seasonal wetland would be constructed adjacent to the expanded pond, with a storage volume of approximately 400 acre-ft up to 1.5' NGVD, 650 acre-ft up to 3.5' NGVD, and higher capacity if filled beyond 3.5' NGVD (see calculations in Appendix B).Under Revised Alternative 2, the connection to the new seasonal wetland area would be set at approximately 1.5 feet NGVD, which would allow flow at much lower stage levels than at present.

The hydrologic conditions considered in the analysis of the restoration alternatives consisted of 2 scenarios. These scenarios, referred to here as Inflow Conditions A and B, are based on available data and are meant to approximate the 10- and 100-year storm events for existing conditions, respectively. However, a comprehensive statistical evaluation of precipitation, watershed conditions, and runoff was not performed to identify the inputs for these

scenarios. The results of the modeling of Pacheco Pond elevations are presented below in table 4-3 and discussed in greater detail in appendix B.

Table 4-3. Peak Water Surface Elevations in Pacheco Pond (feet NGVD 29)

Case	Inflow Condition A	Inflow Condition B
Existing	6.4	7.6
Alternative 1 & 3	4.5	7.2
Revised Alternative 2	4.6	6.3

Reducing flood stage within Pacheco Pond would reduce water-surface elevations in the lowermost reaches of both Pacheco Creek and Arroyo San Jose, which would enhance surface-water drainage characteristics within the Ignacio Business Park. Since the proposed BMKV expansion would reduce the risk of flooding in Pacheco Pond and the Ignacio Business Park, this impact is considered beneficial.

Impact HYD-2: Potential Change in Pacheco Pond Peak Drainage

The restoration alternatives propose to increase the storage capacity of Pacheco Pond and redirect some or all of the outlet flows of the pond through a hydrologic connection to the restored tidal marsh (or an overflow structure to the seasonal wetland area in Revised Alternative 2 and then to the tidal marsh area) and then to San Pablo Bay, thereby reducing potential constraints on pond drainage imposed by high stages within Novato Creek. These modifications would result in reduced stages within Pacheco Pond for all combinations of Novato Creek, Pacheco Pond watershed, and tidal flooding conditions assessed in the conceptual restoration design. Since Pacheco Pond stages would be reduced during flooding events for all restoration alternatives, this impact is considered beneficial.

Impact HYD-3: Potential Change in Pacheco Pond Overflows into the Leveroni Property

The restoration alternatives propose to increase the storage capacity of Pacheco Pond and redirect some or all of the outlet flows of the pond to the restored tidal marsh (or seasonal wetland and then tidal marsh in Revised Alternative 2) and San Pablo Bay through a flap-gated culvert, thereby eliminating any potential constraints on pond drainage imposed by high stages within Novato Creek. These modifications would result in reduced stages within Pacheco Pond for all combinations of Novato Creek, Pacheco Pond watershed, and tidal flooding conditions assessed in the conceptual restoration design. They would also result in reduced frequency of overtopping events of the existing Leveroni Property levee for all restoration alternatives. This impact is considered beneficial.

Impact HYD-4: Potential Change in Novato Creek Peak Flood Stage

The restoration alternatives would redirect some or all of the Pacheco Pond outlet flows from Novato Creek to a flap-gated culvert that flows directly to the restored tidal wetland (or seasonal wetland in Revised Alternative 2) and San Pablo Bay. This modification would reduce flows into the lower reach of Novato Creek, reducing flood stage in Novato Creek during coincident Pacheco Pond and Novato Creek flood events.

To examine the effect of this diversion, stage hydrographs at select locations along Novato Creek are presented in figures 4-5 and 4-6, for Inflow Conditions A and B, respectively. The locations chosen include the upstream limit of the model at the Highway 37 bridge (CS 10), at the existing confluence of Pacheco Pond with Novato Creek (CS 8), and near the location of the proposed design breach (CS 2.8).

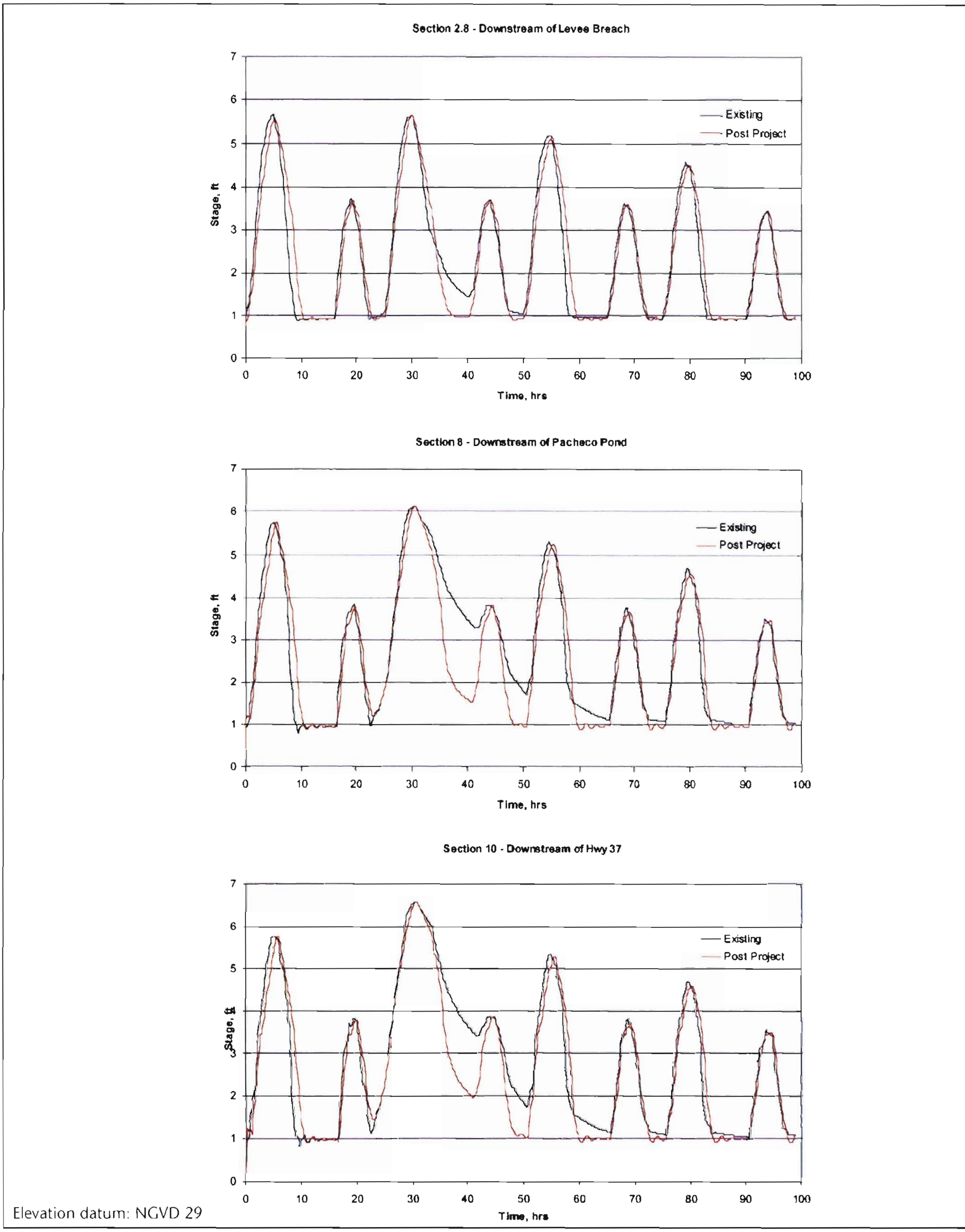
The stage hydrographs shown in these figures suggest that peak water-surface elevations within Novato Creek are controlled primarily by tidal fluctuations. That is, the effects of diverting Pacheco Pond flow, in addition to the added tidal prism created by the constructed tidal marsh, would not significantly change the peak water-surface elevations between existing and future constructed conditions. The changes that would occur are a small reduction (less than 0.25 feet) in peak stage when Pacheco Pond flow is diverted. While peak stages in Novato Creek would not be substantially altered, certain portions of the sub-peak stage (essentially lower portions of the tide cycle) would be lower with the implementation of any of the alternatives.

Since the restoration alternatives would provide for a reduction in flood stage within Novato Creek, albeit minimal, this impact is considered beneficial.

Impact HYD-5: Potential Change in Drainage Capacity from the Bel Marin Keys Lagoons

BMK lagoons presently drain through the existing lock and culvert structures to Novato Creek, when creek stage permits drainage. The lagoons also fill from Novato Creek through these same structures. The BMK south lagoon can also overflow through a culvert structure into the BMKV site. During high stage in Novato Creek, the lagoons cannot be drained.

As part of the restoration design, some or all of the outlet flows from Pacheco Pond would no longer discharge into Novato Creek in the wet season. This modification would reduce sub-peak flood stage in Novato Creek during high flow events and thus enhance the opportunity for lagoon drainage to Novato Creek. As shown in figures 4-5 and 4-6, the diversion of outlet flow and the addition of tidal prism have a negligible effect on peak stage (less than 0.25 feet) in Novato Creek. However, certain portions of the sub-peak stage (lower

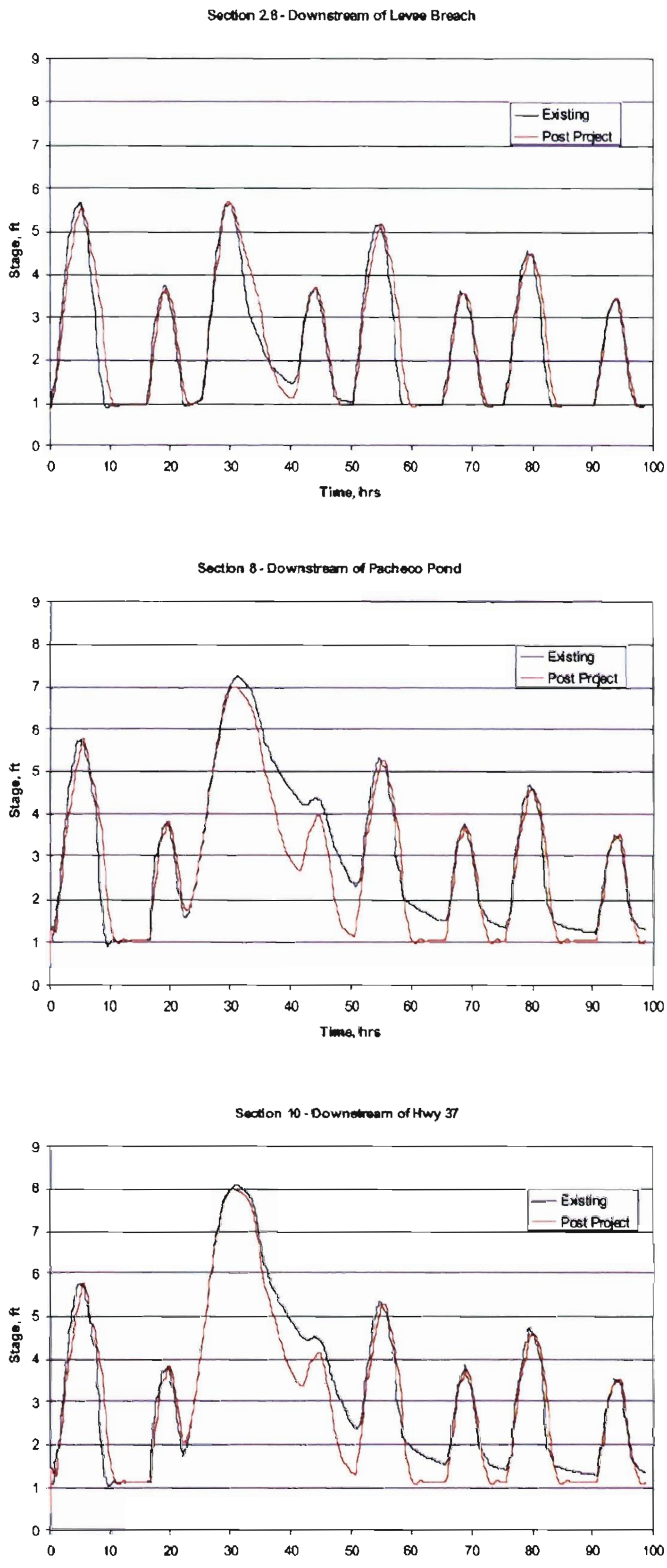


02296.02.002

Jones & Stokes

nhc northwest hydraulic consultants

Figure 4-5
Stage Hydrographs at Select Locations Along Novato Creek, Scenario A



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Elevation datum: NGVD 29

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Figure 4-6
Stage Hydrographs at Select Locations Along Novato Creek, Scenario B

portions of the tidal cycle), would be lower with implementation of any of the 3 alternatives. The model results identified a 0- to 2-foot drop in some portions of the sub-peak stage. It is during the sub-peak stage that the BMK lagoons could be drained. By lowering sub-peak stage, the project would enhance the ability to drain the lagoons between the higher portions of the tidal cycle.

In addition, Alternative 1 and Revised Alternative 2 include improving the existing south lagoon overflow culverts and providing for this overflow into a seasonal wetland/upland swale and improved drainage to Novato Creek.

A preliminary estimate of the amount of possible flow due to direct precipitation in the southern portion of the BMK community (e.g south of Bel Marin Keys Boulevard) including homes, streets and the lagoon was made. The area of the BMK south lagoon and the homes and streets that drain to the lagoon is approximately 242 acres. The estimated area of the swale in Revised Alternative 2 is about 387 acres. Based on the NOAA *Precipitation-Frequency Atlas of the Western United States (NOAA 1973)*, the 100-year 24-hour precipitation for the project area is 6 inches. For the swale area, south lagoon, and homes and streets that drain to the south lagoon this corresponds to about 315 acre-feet. The new overflow structures would be set at 1.5' NGVD to allow overflow into the BMKV swale when the lagoon exceeds this elevation as required by the existing BMK CSD easement. In Revised Alternative 2, the swale would have a capacity of about 450 acre-feet (below 1.5' NGVD) to over a 1000 acre-feet (below 3.5' NGVD), which could contain the flow noted above over several tidal cycles, until the swale can fully drain. The maximum capacity of the swale would be higher than cited here, as the swale could theoretically fill to the height of the lagoon levee (5' NGVD), though this is unlikely. Estimates of ponding capacity for the preferred alternative are included in a spreadsheet in appendix B.

Alternative 3 provides for new lagoon pumping facilities to drain the south lagoon during periods of high lagoon stage.

Revised Alternative 2 includes improvements to the levees west of the existing BMK south lagoon lock. These improvements would reduce the ability of high stage in Novato Creek to flank the south lagoon lock, flow across Bel Marin Keys Boulevard, and enter the south lagoon directly. By reducing the likelihood of bypass flow, these improvements, in combination with the accomodation of overflow into a swale on BMKV, in combination with the ability to discharge to the BMKV swale (or to pump overflow in Alternative 3), the proposed project would improve the ability to control stage in the lagoon itself.

None of the alternatives involve modifications to the normal lagoon operations, such as flushing events, nor do they increase inflow into the lagoons during normal or high stage flow. Therefore, the alternatives are not expected to result in increased sedimentation of the lagoons themselves. The lagoons are filled with tidal flow from Novato Creek and the Pacheco Pond outflow provides little to the base flow of Novato Creek, except under storm conditions. Thus, the redirection of some or all of the Pacheco Pond outflow during the wet season is

not expected to significantly effect the ability to flush the BMK lagoons. Since the restoration alternatives would overall result in improvements to drainage conditions from the BMK lagoons, this impact is considered beneficial.

Impact HYD-6: Potential Increases in Tidal Flooding

All of the restoration alternatives would breach and lower the outboard levee between BMKV and the San Pablo Bay, thereby opening the eastern portion of the site to tidal inundation and potential tidal flooding. Alternative 1 and Revised Alternative 2 would also breach the Novato Creek/BMKV levee. All restoration alternatives include an upland transition berm and levee structure that would be constructed to an elevation above the 100-year tidal flood elevation, with an allowance for settling. This outboard levee is designed to prevent direct tidal intrusion into the western portion of the site, including the swale, upland, seasonal wetland, and the expanded part of Pacheco Pond for tidal elevations below the 100-year tide. Since this feature would not increase the potential for tidal flooding and incorporates design features for new levees that would be exposed to tidal flows, this impact is considered less than significant.

Impact HYD-7: Potential Inconsistency with Flood Zoning

Based on the hydrologic and hydraulic analysis conducted for the BMKV expansion, the restoration alternatives are not expected to result in an adverse physical effect on flooding related to Novato Creek, Pacheco Pond, or adjacent properties, such as the BMK community.

The purpose of the F-1 zone is to protect life and property within the designated zone and to prevent random, uncontrolled development from impeding passage of floodwaters within the zone and increasing flooding. All of the restoration alternatives include removal of the levee that separates the BMKV site from Novato Creek, which would enhance passage of floodwaters from Novato Creek to San Pablo Bay by increasing the width of the flood channel along the perimeter of the BMKV site. None of the alternatives includes any filling or placement of structures within the F-1 zone, and thus the project overall appears to be consistent with the F-1 zoning requirements. However, MCFCWCD is the responsible agency for determining the applicability and consistency of proposed actions related to the county flood zoning ordinances, and a determination of consistency with the F-1 zoning requirements has not been made by MCFCWCD as of this final SEIR/EIS.

The F-2 zone covers the remainder of the BMKV site. The purpose of the F-2 zone is to protect life and property and prevent increased flooding caused by random, uncontrolled development that would decrease the capacity of secondary floodplains to receive overflow floodwaters. As described above, the wetland restoration alternatives are protective of life and property, provide a net reduction

in localized flood risk around Pacheco Pond, do not result in an increase of flood stage in Novato Creek, and do not impede passage of floodwaters.

The restoration alternatives include placement of fill in the form of dredged material, levee construction, and natural sedimentation. The restoration alternatives do not include any specific design features to replicate the ultimate channel or its equivalent. However, as noted above, the restoration alternatives are expected to lower relative stage in Pacheco Pond and are not expected to cause an increase in stage in Novato Creek.

The project would not eliminate all ponding capacity on the site. It would establish hydrologic connections to the remaining ponding capacity, so that capacity would be as effective or more effective than existing ponding capacity, in particular related to the projected lowering of Pacheco Pond peak stage, which would not occur without the project. Though fill (in the form of levees) and tidal inundation would lower the theoretical ponding capacity on the site, the change in hydrologic connections makes the remaining ponding capacity more effective by providing hydrologic connections that route flow onto the BMKV site at a far lower stage than possible at present.

The preferred alternative, Revised Alternative 2, includes designs for hydrologic connections from Pacheco Pond and the BMK south lagoon to retention areas on the BMKV parcel. Based on a preliminary estimate, the 387-acre swale area would have a ponding capacity of about 450 acre-feet at the overflow structure invert elevation of 1.5' NGVD and a ponding capacity of over 1,000 acre-feet when the water surface elevation in the swale reaches 3.5' NGVD (assuming overflow structures are 24" culverts). The maximum capacity would depend on the final design for the swale and the overflow structures, as it is possible for the swale to fill to the adjacent levee design height of 5' NGVD. The expanded Pacheco Pond/emergent marsh area would have a capacity of 175 acre-feet (between 1.5' NGVD and 7' NGVD). The 136-acre seasonal wetland area connected to the expanded Pacheco Pond would have a ponding capacity of about 400 acre-feet below the 1.5' NGVD invert elevation of the overflow structure and a capacity of about 650 acre-feet when the water surface elevation in the seasonal wetland reached 3.5' NGVD (assuming the overflow structures are 24" culverts). The maximum ponding capacity of the seasonal wetland will depend on the final design for the seasonal wetland and the overflow structure. Ponding estimates are included in a spreadsheet in appendix B.

The ponding capacity of the tidal marsh wetland adjacent to Novato Creek varies with the tide and thus was not calculated. However, with the lowering of the outboard levee along Novato Creek to around MHW (approximately 2.8 feet NGVD), the tidal marsh restoration area could also receive overflow from the creek across the lowered levee.

In high-flow events, what influences water surface elevations is the effective routing of flow away from the primary floodway. As noted above, the proposed project is not expected to increase peak water surface elevation in Novato Creek

and would actually lower sub-peak elevations during high-flow events, relative to the existing setting. As a measure of effective ponding capacity, the proposed project provides hydrologic connections that are at least equivalent to current connections, and potentially improved for sub-peak conditions. Further, in relation to Pacheco Pond, all alternatives provide an increase in overflow capacity that would actually reduce peak stage.

Based on the results of the hydrologic and hydraulic studies to date, the Corps and Conservancy consider that the proposed project would actually increase effective ponding capacity and thus should be considered in compliance with the flood zoning. However, MCFCWCD has yet to make this determination.

NEPA and CEQA require an evaluation of whether a physical effect is a significant effect on the environment. The completed hydrologic and hydraulic analysis has not identified an adverse physical effect on flooding. MCFCWCD has not formally determined whether the restoration alternatives are consistent with the requirements of the flood zoning ordinances. Pending that determination and for the purposes of significance determination only, it is assumed as of this draft SEIR/EIS that the restoration alternatives are not consistent with the F-2 zoning requirements. The Corps and Conservancy, as the CEQA and NEPA lead agencies, considered the conclusions of the completed hydrologic and hydraulic analysis; the physical effects of filling, constructing new levees, breaching/lowering the perimeter levees, diverting some or all of the Pacheco Pond outlet flow; and the potential inconsistency with the F-2 zoning, in addition to the intensity and context of this impact, prior to determining whether a significant effect on the environment related to flooding may occur with implementation of the BMKV expansion. After considering these factors, the lead agencies determined that this is a less-than-significant effect on the environment related to flooding because, although it may later be determined that the project is inconsistent with the local flood zoning ordinance, the project is not expected to result in an increased flood risk to people or property and is expected to result in a minor decrease in flood stage around the perimeter of Pacheco Pond.

In recognition of the concerns of the City of Novato, Marin County, and local residents concerning the F-2 zoning (as well as the MCFCWCD easements) relative to the site, the Conservancy, MCFCWCD, and the City of Novato have developed an Agreement that establishes a process by which further hydrologic and hydraulic studies will be developed, completed, and reviewed to examine the potential effects of the proposed project on water surface elevations in Novato Creek and other parts of the lower portion of the Novato Creek watershed. Although the lead agencies believe that the further studies are beyond what is necessary for impact assessment under NEPA and CEQA, the Conservancy as the local sponsor of the project has agreed to conduct these additional studies that the City and County believe are necessary to make determinations concerning the consistency of the project with the F-2 zoning and MCFCWCD easements. The lead agencies fully expect that these additional studies will confirm the results of the studies to date and the conclusion in the SEIR/EIS that the proposed project

would not increase flooding, and thus do not believe these studies are necessary for the completion of the NEPA and CEQA processes. The Agreement contains performance standards that the additional studies must show the proposed project to meet. These performance standards are that the proposed project must be shown not to increase peak water elevations in Novato Creek, Arroyo San Jose, Pacheco Creek, Pacheco Pond, Bel Marin Keys lagoons, or any other part of the Novato Creek watershed. If the studies do not show this (which the project sponsors think is highly unlikely), the Conservancy has agreed not to proceed with construction of the project until flooding issues are resolved to the satisfaction of the City of Novato and Marin County. The Agreement is included in appendix I.

Impact HYD-8: Potential Conflict with Existing Drainage Agreements

The areas of the 1980 and 1987 MCFCWCD drainage agreements would be partially filled under Alternative 1 and Revised Alternative 2 by dredged fill and natural sedimentation and by natural sedimentation under Alternative 3. As noted above, Revised Alternative 2 contains a swale area with a ponding capacity of 450 acre-feet (below the 1.5' NGVD elevation of the overflow invert) to more than 1,000 acre-feet (when water fills to 3.5' NGVD or greater) connected to the BMK south lagoon, an expanded pond area with capacity of 175 acre-feet, and a seasonal wetland area connected to the expanded Pacheco Pond with a ponding capacity of 400 to 650 acre-feet (up to 1.5' and 3.5' NGVD respectively). The ponding capacity of the tidal marsh wetland adjacent to Novato Creek varies with the tide and thus was not estimated. Based on the results of the hydrologic and hydraulic studies to date, the Corps and Conservancy consider that the project would actually increase effective ponding capacity, and thus should be considered in compliance with the MCFCWCD easements. However, MCFCWCD has yet to make this determination. This determination will be made upon completion of the additional studies conducted as part of the MOA mentioned above.

If it is determined by MCFCWCD that sufficient ponding capacity is retained to replace that of the drainage agreements, the drainage agreements could be amended to reflect the new ponding areas present with restoration. The Conservancy is willing to work with MCFCWCD to record amended drainage easements for the new ponding areas if MCFCWCD determines this is necessary to comply with the easements.

Pending MCFCWCD determination and for the purposes of significance determination only, it is assumed for the SEIR/EIS that the restoration alternatives are not consistent with the MCFCWCD easements. The Corps and Conservancy, as the CEQA and NEPA lead agencies, considered the conclusions of the completed hydrologic and hydraulic analysis; the physical effects of filling, constructing new levees, breaching/lowering the perimeter levees, and diverting some or all of the Pacheco Pond outlet flow; and the potential

inconsistency with the easements, in addition to the intensity and context of this impact, prior to determining whether a significant effect on the environment related to flooding may occur with implementation of the BMKV expansion. After considering these factors, the lead agencies determined that the BMKV expansion would have a less-than-significant effect on the environment related to flooding because, although it may later be determined that the project is inconsistent with the easements, the project is not expected to result in an increased flood risk to people or property and is expected to result in a minor decrease in flood stage around the perimeter of Pacheco Pond.

The 1997 BMK CSD drainage agreement that allows for overflow from the BMK south lagoon would be accommodated by overflow structures under Alternative 1 and Revised Alternative 2 leading to the swale area, and by a relief pump under Alternative 3. As noted above, a conservative estimate of the 100-year 24 hour precipitation amount for the south lagoon, the houses and streets that drain to the south lagoon, and the BMKV swale (in Revised Alternative 2) is about 315 acre-feet. Under Revised Alternative 2 the capacity of the swale below 1.5 feet NGVD is estimated to be around 450 AF, which is adequate to hold the potential flow until it can be discharged to Novato Creek on the low tide. The capacity of the swale up to 3.5' NGVD would be over 1,000 AF. Alternative 1, similar to Alternative 2, would also include a swale sized to accommodate overflow; while the pump or pumps in Alternative 3 would be sized to handle sufficient overflow to comply with the easement. Thus, the restoration alternative designs are considered to be compliant with the requirements of the BMK CSD drainage agreement, and this is considered a less-than-significant impact. The Conservancy will continue to consult with the BMK CSD during the detailed design phase concerning the new overflow structures to be built to deliver high-stage flow from the lagoon to the new swale.

Impact HYD-9: Potential Changes in Flood Zone Mapping and Flood Insurance

This impact discussion has been added since the Draft SEIR/EIS to address concerns expressed in some of the comments that the proposed project may result in flood zone changes that might result in a change in flood insurance rates for adjacent residential areas and that the proposed project would affect the ability of the local community to participate in the National Flood Insurance Program.

Because a portion of the site would be opened up to tidal action, the portion of the BMKV site eastward of the new outboard levee would be remapped from an A zone (riverine flooding) to a V zone (coastal flooding). However, the new outboard levee would be designed to prevent tidal flooding from reaching the remainder of the BMKV site, thus the current FIRM mapping of the remainder of the site is likely to remain unchanged. All of the restoration alternatives would change flood mapping zones on the BMKV site itself, but would not change flood mapping of adjacent areas; the hydrologic and hydraulic studies conducted as part of the conceptual design determined that the project would not result in an

increase in flood stage in adjacent water bodies or increased risk of flooding to adjacent properties.

FEMA periodically updates the FIRM maps based on new FISs. New studies utilize the latest data reflecting the physical conditions within a studied community relevant to flooding. These new studies sometimes result in changes in mapping of SFHAs. Based on the hydrologic and hydraulic studies to date, the proposed BMKV expansion would not result in changes that would be the basis for SFHA mapping changes, except those relevant to the tidal marsh restoration area on the BMKV site itself.

The FIS studies are engineering studies that focus on the physical nature of communities relevant to flooding. The 1986 FEMA FIS for the unincorporated area of Marin County makes no mention of the F-2 zoning. In conversation with several MCFCWCD staff members concerning the BMKV project, none has identified any direct relationship between the F-2 zoning and FEMA FIRM mapping or any mention of F-2 zoning in FEMA flood studies. As noted above, a local community must adopt floodplain management regulations in order to participate in the NFIP. The F-2 zoning is part of MCFCWCD floodplain management regulations. As discussed above, the local flood zoning prohibits fill in the F-2 zone if it would reduce the ponding capacity of a site by more than 25%. As described above, the hydrologic and hydraulic studies have demonstrated that, although fill would be placed on the site, the restoration alternatives would not result in a loss of ponding capacity that would result in an increase in flood levels.

Based on the hydrologic and hydraulics study results, the proposed project is considered consistent with FEMA floodplain management criteria.

The Conservancy, as the state lead agency and owner of the BMKV site, has stated in the Agreement with the City of Novato and MCFCWCD that, in the unlikely event that the confirmatory studies to be done under the Agreement indicate that the project would increase peak flood levels above baseline in Novato Creek, Pacheco Pond, the BMK lagoons, or any other part of the Novato Creek watershed, it would not proceed with construction of the project until flooding issues are resolved.

Since no project-related changes in offsite flood zoning mapping are expected, flood insurance rates are not expected to be affected, nor is the ability of the local community to participate in the NFIP. The change of flood zone mapping on the site itself is not considered an adverse or significant effect on the environment.

Impact TH-1: Modification to Circulation in San Pablo Bay

Tidal fluctuations into and out of the restored tidal wetlands under Alternative 1, Revised Alternative 2, and Alternative 3 would generate large tidal currents in and around the perimeter levee breaches. The subtidal channels connecting the basins to the Bay would convey flows of up to 3,000 cfs in areas where no tidal

currents exist today. The fluid momentum associated with these flows would be rapidly dissipated along the mud flats as the channels discharge into San Pablo Bay. However, because of the vast size and volume of San Pablo Bay, the general effect of this momentum exchange away from the point of discharge would be insignificant. Thus, large-scale circulation patterns in San Pablo Bay would not be significantly affected by the restoration alternatives, and the impact would be less than significant.

Impact TH-2: Changes in Circulation and Morphologic Evolution in Existing Tidal Wetlands

For the tidal marshes to properly evolve, adequately sized connecting channels would have to be maintained to provide full tidal exchange between the basins and San Pablo Bay. Under-sized connecting channels would reduce the amount of sediment-laden water reaching each basin by creating a hydraulic choke. This could inhibit the morphologic evolution of the wetlands to such a degree that the project objectives might not be achieved, and the loss of biological resources might not be offset by the restoration alternatives. Therefore, this impact to biological resources could be significant. For further discussion and proposed mitigation, see the discussion under the *Biological Resources* section of this chapter.

Impact TH-3: Potential Changes in Lower Novato Creek Morphology due to Diversion of Pacheco Pond Outlet Flows

The restoration alternatives would redirect some or all of the Pacheco Pond outlet flows in the wet season from Novato Creek to the tidal wetlands and San Pablo Bay through a flap-gated culvert (Alternatives 1 and 3), or to seasonal wetlands on BMKV and then to San Pablo Bay (Revised Alternative 2). Daily tidal excursions through Novato Creek are the dominant hydraulic control on the present size and morphology of lower Novato Creek. Hydrologic and hydraulic modeling of restoration alternatives indicate that stage and flow rate in Novato Creek are primarily controlled by Novato Creek flows and San Pablo Bay tidal stage. Pacheco Pond flows can contribute flows to Novato Creek during periods that Novato Creek stage is lower than Pacheco Pond stage. These contributions, however, are relatively minor compared to the higher frequency of occurrence and magnitude of flows within the lower Novato Creek that result from tidally driven flows during spring tide events. Extreme flow events in Novato Creek may induce episodic changes in creek width and depth, although these changes are relatively negligible with respect to the persistent energy imparted by tidal flows. Since the morphology of the subtidal channel of lower Novato Creek is primarily controlled by Novato Creek hydrology and tidal conditions within San Pablo Bay, any small changes in lower Novato Creek morphology due to diversion of some or all of the Pacheco Pond outlet flows are considered less than

significant. These changes, as discussed in *Land Use and Utilities* below, are not expected to have a significant effect on the navigability of Novato Creek.

The project includes a Monitoring, Maintenance, and Adaptive Management Plan (MAMP). The draft MAMP is included in appendix K. The MAMP includes monitoring of the Novato Creek channel above and below the Pacheco Pond existing outlet before and after diversion of wet season flow to the BMKV site. Although adverse effects are not expected on morphology or navigation, monitoring of the channel in the context of the MAMP offers a mechanism to confirm the estimated effects on morphology. In the unlikely event that monitoring identifies a project-related significant effect on morphology or navigation, the MAMP also offers a mechanism to consider potential corrective actions.

Impact TH-4: Potential Changes in Pacheco Pond Outlet Channel due to Diversion of Outlet Flow

The restoration alternatives would redirect some or all of the flows from the existing Pacheco Pond outlet in the wet seasonto Novato Creek to the tidal wetlands and San Pablo Bay through a flap-gated culvert (Alternatives 1 and 3), or to seasonal wetlands on BMKV through a weir and then to San Pablo Bay through a flap-gated culvert (Revised Alternative 2). Depending on the amount and timing of diversion of flows, it is possible that sedimentation may cause the outlet channel between Bel Marin Keys Boulevard and Novato Creek to fill in. The project includes development of a new water management plan, in cooperation with MCFCWCD and DFG, to identify options for managing Pacheco Pond wildlife habitat and flood control. The water management plan should be developed in tandem with the engineering design of the restoration project. Because the existing outlet would be used for any dry-season flow, it is expected that the new plan would result in parameters for dual operation of the 2 future outlets from the pond (to Novato Creek and to BMKV) in the wet season. The purpose of dual operation would be to maximize flood control and wildlife habitat benefits, while maintaining some flow along the existing outlet channel to Novato Creek to reduce sedimentation in the channel. It is possible that, for flood control purposes during high-stage events in Novato Creek, it may be determined best to close the existing outlet at Novato Creek and divert all flows to the restoration site during the storm event. However, under non-storm events, it may be determined feasible to operate both outlets. With implementation of a new management plan, the impact to sedimentation in the channel is expected to be less than significant. Potential effects on habitat due to diversion of the existing Pacheco Pond outlet flow are discussed in the *Biological Resources* section of this chapter.

Impact TH-5: Outboard Marsh Shoreline Erosion

Tidal circulation between the restored tidal marsh and San Pablo Bay is not expected to induce or aggravate erosion of existing tidal marsh shoreline along San Pablo Bay. However, the proposed BMKV expansion would involve excavation of channels through the existing outboard marsh. Additional erosion of the outboard marsh surface can be expected if the channels widen in response to an increase in tidal exchange. The loss of existing tidal marsh is considered a less-than-significant impact because a primary purpose of the alternatives is the creation of new and additional tidal marsh habitat. The proposed BMKV expansion is designed to create tidal marsh habitat over and above the amount lost by excavation and erosion of the connecting outboard channels.

Impact TH-6: Excessive or Unexpected Erosion of Perimeter Levees

Perimeter levees adjacent to restoration basins could be subject to increased erosion from current and wave forces. Tidally driven circulation and currents are expected to develop in the basins due to tidal fluctuations, although the velocities are not expected to be high enough to pose a significant erosion risk to adjacent levee structures. Final design studies will be undertaken to investigate and quantify tidal currents in each marsh basin to better assess the risks of localized erosion.

Wind-generated waves pose a more significant erosion risk on perimeter levees than tidal currents. The size of wind-generated waves is primarily a function of the wind speed, wind fetch, wind duration, and water depth. Erosion from wind-generated waves can be minimized or eliminated by the use of appropriate levee materials, levee geometric design, and wave dissipation structures, and by reducing wind fetch and therefore the opportunity for wind waves to develop. The alternative designs presented in the conceptual plan (see figure 3-12 in chapter 3) utilize a combination of levee berms for providing wave dissipation and erosion protection, and internal peninsulas for reducing wave fetch and resulting wave heights.

Additional geotechnical and engineering studies will be conducted as the part of final design. The final design will include properly sized levees, levee erosion-protection measures, and internal peninsulas to prevent any significant impacts caused by levee erosion. Therefore, the impact of perimeter levee erosion is considered less than significant.

The potential exposure of levees to tsunamis or seiches is discussed in the *Geology, Soils, and Seismicity* section of this chapter.

Impacts and Mitigation Measures Common to Alternative 1 and Revised Alternative 2

Impact TH-7: Modification to Sedimentation Processes and Morphology in San Pablo Bay

The marsh plains in the BMKV tidal basins would accrete naturally by capturing sediments transported into the basins through tidal exchange. The sediment would consist mainly of bay muds resuspended by wave and wind activity and fine suspended sediment carried from upland sources by drainages emptying into San Pablo Bay, including Novato Creek. The capture of sediment in the basins would result in lower local sediment concentrations in the Bay, which could affect local sedimentation and morphological processes.

The conceptual design plans for Alternative 1 and Revised Alternative 2 include perimeter levee breaches and connecting channels along the San Pablo Bay shoreline and at the mouth of Novato Creek. Both alternatives call for the importation and placement of dredged material during the construction phase, which would significantly reduce the resultant tidal prism volume of each basin after breaching. Preliminary calculations of the sediment loading required to sustain maximum accretion rates in the basins range between 0.08 and 0.23 million tons of Bay sediments per year (assuming a bulk density of 1.3 grams per cubic centimeter) for the first 10 years. This is equivalent to only about 2–7%of the total estimated sediment inflow into San Pablo Bay from the Sacramento and San Joaquin Rivers combined (3.4 million tons per year). The sediment requirements of the basins for Alternative 1 and Revised Alternative 2 would also be relatively ephemeral and would be reduced to less than 1% after 20 years. The effect of sediment capture on the sedimentation processes and morphology of San Pablo Bay is thus considered a less-than-significant impact.

Impact TH-8: Modifications to Sedimentation Processes and Morphology of Novato Creek due to Breach of BMKV/Novato Creek Levee

The conceptual design plans for Alternative 1 and Revised Alternative 2 include a marsh basin connection to Novato Creek through a single levee breach. The breach would be located at the downstream end of the creek, only a few thousand feet from San Pablo Bay. Preliminary analysis of local scour from increased tidal prism reveals likely channel widening of between 10 and 40 feet along the portion of Novato Creek from the breach to the mouth , a distance of approximately 4,000 feet (see figure 4-7). The estimated change in depth is an increase of approximately 0.5 to 1.0 feet. These changes would be expected to occur along the existing main channel. Due to the short length of this corridor, it is estimated that only between 2 and 5 acres of tidal marsh floodplain along the creek channel would be lost to erosion. This impact is considered a less-than-

significant impact on habitat because a primary purpose of the alternatives is the creation of new and additional marsh habitat, and the amount lost to erosion along Novato Creek would be more than compensated for by the habitat created by implementing the alternatives. See discussion of navigability below.

In addition to main channel widening, the subtidal channel beyond the mouth of Novato Creek to the Petaluma channel (a distance of approximately 2000 feet between Marker 25 and Marker 7) would also be subject to an increased tidal flow due to an increase in tidal prism. It is expected that 10 to 15 acres of existing mudflat along the subtidal channel would be eroded into mudflat channel because of the increased tidal prism from the upstream marsh basin connection (see figure 4-7). However, the loss of 10 to 15 acres of existing mudflat represents a small fraction of the total existing fringe mudflat along San Pablo Bay, and the proposed BMKV expansion is expected to create more than 50 acres of new mudflat habitat. This is considered a less than significant impact on habitat. See discussion of navigability below.

Regarding short-term sedimentation immediately after the breach of the Novato Creek levee, the potential exists for limited amounts of unconsolidated material to be mobilized from the project site during ebb tides. This potential increase in transport of colloidal particles would weakly increase the suspended sediment effluent concentration from the site on ebb tides immediately following the breach of the Novato Creek levee. The plume of slightly elevated suspended sediment would quickly dissipate through advection (flow in the creek) and dispersion in the Bay. Suspended sediment concentrations entering the creek on flood tides would be at or near ambient Bay suspended sediment concentrations. Increased tidal flow would produce a net increase in tidal scour that would more than offset the temporary increase of suspension of sediments. Ebb-tide suspended sediment concentrations from the project site would decrease below ambient Bay suspended sediment concentrations following the breach as the site materials consolidate and the site reverts to a net sediment sink.

Regarding long-term sedimentation, the tidal basin itself is attached to the Novato Creek breach and is designed as a sediment trap in order to capture natural sediment to form the final cover for the restored wetland area. Thus, during formation of final marsh elevations after breach (a process that would take approximately 10-20 years), the site would actually capture a portion of the sediment from Novato Creek and San Pablo Bay flows. The functioning of the site as a sediment trap until marsh plain equilibrium is reached and the increase in tidal flows below the breach would result in a net erosional effect in the creek channel, as noted above. No long-term increase in sedimentation is expected.

Regarding navigation, these changes in morphology of the lower portion of Novato Creek are expected to occur directly adjacent to the existing main channel of Novato Creek from the breach to the mouth, and in the tidal mudflat north and south of the subtidal channel from the mouth (Marker 25) to the Marker 7 (see figure 4-7). The addition of tidal prism volume from the marsh basin is expected to increase the width and equilibrium depth of Novato Creek.

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Figure 4-7
Novato Creek and Outer Navigation Channel

However, these changes will occur only on the reach downstream of the breach and should not affect the upstream hydraulics of the creek. It is also important to note that these changes are not expected to have a significant adverse effect on the navigability of Novato Creek. In addition to the downstream reach of Novato Creek, the tidal mudflat along the subtidal channel would erode by between 10 to 15 acres. This erosion will likely occur along the sides of the subtidal channel, but may also occur along the channel invert.

Since this downstream reach of Novato Creek presently requires maintenance dredging to provide adequate channel size for boat passage, the addition of tidal prism is an incidental beneficial effect of the project on navigability of Novato Creek, although the authorized purpose of this project is not navigation. It should be noted that the project's potential addition of 400 to 600 acres of tidal prism (depending on the alternative chosen) to this portion of Novato Creek is not expected to result in sufficient channel width or depth to eliminate the need for future maintenance dredging.

As noted in chapter 3, the project includes a Monitoring and Adaptive Management Plan (MAMP). The draft MAMP is included in appendix K. The MAMP includes monitoring of the Novato Creek channel above and below the proposed Novato Creek breach before and after the breach is excavated. Although adverse effects on navigation are not expected, monitoring of the channel in the context of the MAMP offers a mechanism to confirm the estimated effects on morphology. In the unlikely event that monitoring identifies a project-related significant effect on morphology or navigation, the MAMP also offers a mechanism to consider potential corrective actions.

Impact TH-9: Potential Increase in Existing Levee Erosion on Novato Creek

Both Alternative 1 and Revised Alternative 2 propose breaching and lowering the levee that separates Novato Creek from the BMKV site. The levee breach would increase existing peak tidal flows in lower Novato Creek from 1500 cfs to between 3000 and 5000 cfs. Local peak velocities downstream of the breach would increase from 2 feet per second to 4 to 6 feet per second in some sections during peak ebb tidal flow. This would result in localized widening (10 to 40 feet) and deepening (0.5 to 1.0 feet) of the existing subtidal Novato Creek channel from the location of the levee breach to the mouth of Novato Creek. However, the velocity increases and associated channel erosion would be limited to the main creek channel. Since the perimeter levees are set back from the main channel and are built on an elevated floodplain, the velocity increases near the levees would be negligible. Therefore, the shear stresses on the existing Novato Creek levees would not be significantly higher, and the impact would be considered less than significant.

Impact TH-10: Modification to Circulation in Novato Creek

The hydraulic model predicted a peak tidal flow increase from an existing 1,500 cfs to about 3,000 to 5,000 cfs with the breach in place in Novato Creek. Existing peak tidal velocities of 2 feet per second would increase to between 4 and 6 feet per second in some sections. While flows would be amplified compared to the present conditions, the addition of tidal flow is not expected to change circulation patterns within the creek itself or downstream in San Pablo Bay. Because the increase of tidal flow would only amplify existing tidal flows but would not change circulation patterns, this is not considered a significant impact.

Impacts and Mitigation Measures Unique To Alternative 3

Impact TH-11: Modification to Sedimentation Processes in San Pablo Bay

The Alternative 3 design relies on tidal exchange and natural accretion processes to develop marsh plains rather than direct placement of dredged material to accelerate development of tidal marsh conditions. For this reason, the combined tidal prism volume of the Alternative 3 basins would be substantially larger during the initial years of the projects, and the rate of sediment transport into the basins would be greater. Preliminary calculations of the sediment loading required to sustain maximum accretion rates in the basins range between 0.8 and 1.2 million tons of material per year for the first 10 years. This is equivalent to about 25–34% of the estimated average sediment inflow into San Pablo Bay from the Sacramento and San Joaquin Rivers combined. This impact is far more substantial than the impacts associated with Alternative 1 and Revised Alternative 2, and is considered significant. To mitigate this impact, the Conservancy or successors in interest shall implement Mitigation Measure TH-1.

Mitigation Measure TH-1: Perform an Assessment of Modifications to Sedimentation Processes in San Pablo Bay for Alternative 3 and Implement Phased Tidal Basin Development, if Necessary.
The volume of sediment captured each year by the design plan outlined in Alternative 3 could be reduced in half by phased development of the 2 basins. Opening only a single basin during the initial phase of the proposed BMKV expansion would reduce the maximum catch rate to about 0.55 million tons per year. This is equivalent to about 16% of the total estimated sediment inflow into San Pablo Bay from the Delta. After approximately 25 to 30 years, this value would drop to less than 3%. Once the capture rate of the first basin is no longer significant, the 2nd basin would be opened to tidal action.

Water Quality

Affected Environment

Data Sources

The evaluation of water quality effects is based on information presented in the following documents.

- *Hamilton Army Airfield Disposal and Reuse EIS* (U.S. Army Corps of Engineers 1996a)
- San Francisco Bay Plan (San Francisco Bay Conservation and Development Commission 2001)
- Regional Toxic Hot-Spot Cleanup Plan (San Francisco Regional Water Quality Control Board 1999)
- *Draft – Beneficial Reuse of Dredged Materials: Sediment Screening And Testing Guidelines* (San Francisco Regional Water Quality Control Board 2000a)
- *Report of the San Francisco Airport Science Panel* (National Oceanic and Atmospheric Administration1999)
- San Francisco Bay Region–Water Quality Control Plan (San Francisco Regional Water Quality Control Board 1995)
- Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California – Phase 1 of the Inland Surface Waters Plan and the Enclosed Bays and Estuaries Plan (State Water Resources Control Board 2000)
- *CALFED Bay Delta Program Final Programmatic EIR/EIS* (CALFED Bay Delta Program 2000)
- *Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs, and Organochlorine Pesticides.* Final Report. (Kinnetic Laboratories Incorporated 2002)
- Results of analyses for Pacheco Pond water samples collected on April 19, and April 20, 2001, for the San Francisco Regional Water Quality Control Board (Sequoia Analytical 2001)

Regulatory Setting

Federal Plans, Programs, and Policies

Clean Water Act

The EPA has granted the State of California primacy in administering and enforcing the provisions of the Clean Water Act (CWA) and NPDES. NPDES is the primary federal program that regulates point-source and nonpoint-source discharges to waters of the United States.

The State of California adopts water quality standards to protect beneficial uses of state waters as required by Section 303 of the CWA and the Porter–Cologne Water Quality Control Act of 1969 (PCWQCA).

Placement of clean fill materials into waters of the United States is regulated by Section 404 of the CWA, which is administered by the Corps. Under the CWA, the state RWQCB must issue Section 401 Water Quality Certification or a waiver for a project[1] to be permitted under Section 404. Water quality certification requires the evaluation of water quality considerations associated with dredging or placement of fill materials into waters of the United States.

State Plans, Programs, and Policies

The McAteer–Petris Act of 1965

The McAteer–Petris Act, enacted on September 17, 1965, established the San Francisco Bay Conservation and Development Commission (BCDC) as a temporary state agency charged with preparing a plan for the long-term use of the Bay (Bay Plan). In August 1969, the McAteer–Petris Act was amended to make BCDC a permanent agency and to incorporate the policies of the Bay Plan into state law.

Any person or governmental agency wishing to place fill, extract materials, or make any substantial change in use of any water, land, or structure within the area of BCDC's jurisdiction must secure a permit from BCDC. Upon receiving an application for a permit, BCDC will transmit a copy of the application to the San Francisco Bay RWQCB. Within 30 days, the RWQCB must file a report with the commission that indicates the effect of the proposed project on water quality within the Bay. The main dredging policies that govern BCDC are listed below.

- Policy 1: Dredging and dredged material disposal should be conducted in an environmentally and economically sound manner.

[1] The term *project* used in this SEIR/EIS refers explicitly to the term as defined under CEQ's regulations for NEPA and the State CEQA Guidelines: "the entirety of an action which has a potential for resulting in a physical change in the environment." The Corps defines *project* as "an action that has been authorized by Congress," such as the HWRP. The BMKV expansion has not been authorized by Congress.

- Policy 2: Dredging should be authorized when the Commission can find:
  a. the applicant has demonstrated that the dredging is needed to serve a water-oriented use or other important public purpose, such as navigational safety;
  b. the materials to be dredged meet the water quality requirements of the San Francisco Bay Regional Water Quality Control Board;
  c. important fisheries and Bay natural resources would be protected through seasonal restrictions established by the California Department of Fish and Game, the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service, or through other appropriate measures;
  d. the siting and design of the project will result in the minimum dredging volume necessary for the project; and
  e. the materials would be disposed of in accordance with Policy 3.
- Policy 3: Dredged materials should, if feasible, be reused or disposed outside the Commission's Bay and certain waterway jurisdictions. Except when reused in an approved fill project, dredged material should not be disposed in the Commission's Bay and certain waterway jurisdiction unless disposal outside these areas is infeasible and the Commission finds:
  a. the volume to be disposed is consistent with applicable dredger disposal allocations and disposal site limits adopted by the Commission by regulation;
  b. disposal would be at a site designated by the Commission;
  c. the quality of the material disposed of is consistent with the advice of the San Francisco Bay Regional Water Quality Control Board and the inter-agency Dredged Material Management Office (DMMO); and
  d. the period of disposal is consistent with the advice of the California Department of Fish and Game, the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.
- Policy 4: If an applicant proposes to dispose dredged material in tidal areas of the Bay and certain waterways that exceeds either disposal site limits or any disposal allocation that the Commission has adopted by regulation, the applicant must demonstrate that the potential for adverse environmental impact is insignificant and that non-tidal and ocean disposal is infeasible…or because the cost of disposal at alternate sites is prohibitive. In making its decision whether to authorize such in-Bay disposal, the Commission should confer with the LTMS agencies and consider the factors listed in Policy 1.
- Policy 5: To ensure adequate capacity for necessary Bay dredging projects and to protect Bay natural resources, acceptable non-tidal disposal sites should be secured and the Deep Ocean Disposal Site should be maintained. Further, dredging projects should maximize use of dredged material as a resource consistent with protecting and enhancing Bay natural resources, such as creating, enhancing, or restoring tidal and managed wetlands,

creating and maintaining levees and dikes, providing cover and sealing material for sanitary landfills, and filling at approved construction sites.

- Policy 11: A project that uses dredged material to create, restore, or enhance Bay natural resources should be approved only if:

    1. The Commission...determines all of the following:

        a. the project would provide, in relationship to the project size, substantial net improvement in habitat for Bay species;

        b. no feasible alternatives to the fill exist to achieve the project purpose with fewer adverse impacts to Bay resources;

        c. the amount of dredged material to be used would be the minimum amount necessary to achieve the purpose of the project;

        d. beneficial uses and water quality of the Bay would be protected; and

        e. there is a high probability that the project would be successful and not result in unmitigated environmental harm;

    2. The project includes an adequate monitoring and management plan and has been carefully planned, and the Commission has established measurable performance objectives and controls that would help ensure the success and permanence of the project, and an agency or organization with fish and wildlife management expertise has expressed to the Commission its intention to manage and operate the site for habitat enhancement or restoration purposes for the life of the project;

    3. The project is either a small pilot project or the success of similar projects has been demonstrated in similar settings;

    4. The project would use only clean material suitable for aquatic disposal and the Commission has solicited the advice of the San Francisco Bay Regional Water Quality Control Board, the Dredged Material Management Office and other appropriate agencies on the suitability of the dredged material;

    5. The project would not result in a net loss of bay surface area or volume. Any offsetting fill removal would be at or near as feasible to the habitat fill site;

    6. Dredged material would not be placed in areas with particularly high or rare existing natural resource values, such as eelgrass beds and tidal marsh and mudflats, unless the material would be needed to protect or enhance the habitat. The habitat project would not, by itself or cumulatively with other projects, significantly decrease the overall amount of any particular habitat within the Suisun, North, South, or Central Bays, excluding areas that have been recently dredged;

    7. After a reasonable period of monitoring, either:

    a. the project has not met its goals and measurable objectives, and attempts at remediation have proven unsuccessful, or

b. the dredged material is found to have substantial adverse impacts on the natural resources of the Bay, then the dredged material would be removed, unless it is demonstrated by competent environmental studies that removing the material would have a greater adverse effect on the Bay than allowing it to remain, and the site would be returned to the conditions existing immediately preceding placement of the dredged material if; and

8. The Commission has consulted with the California Department of Fish and Game, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service to ensure that at least one of these agencies supports the proposed project.

BCDC must take action on a permit application, either denying or granting the permit, within 90 days after a complete application is filed. The permit will be automatically granted if BCDC fails to take specific action within that time period. A permit will be granted for a project if BCDC finds and declares that the project is either (1) necessary to the health, safety, or welfare of the public in the entire Bay Area; or (2) of such a nature that it will be consistent with the provisions of this title and the provisions of the San Francisco Bay Plan then in effect.

The Porter–Cologne Water Quality Control Act of 1969

The PCWQCA established the State Water Resources Control Board (SWRCB) and divided the state into 9 regional basins, each with a regional RWQCB. The SWRCB is the primary state agency responsible for protecting the quality of the State's surface and groundwater supplies.

The PCWQCA authorizes the SWRCB to draft state policies regarding water quality. In addition, the PCWQCA authorizes the SWRCB to issue Waste Discharge Requirements (WDRs) for discharges into state waters. The PCWQCA requires that the SWRCB or the RWQCB adopt water quality control plans (Basin Plans) for the protection of water quality. A Basin Plan must:

- identify beneficial uses of water to be protected,
- establish water quality objectives for the reasonable protection of the beneficial uses, and
- establish a program of implementation for achieving the water quality objectives.

The Basin Plans also provide the technical basis for determining WDRs, taking enforcement actions, and evaluating clean water grant proposals. The RWQCB adopted the most recent Basin Plan in May 1995. The San Francisco Bay RWQCB has jurisdiction over the expansion area.

Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California

The Enclosed Bays and Estuaries Plan (EBEP) (California State Water Resources Control Board 1990) set forth new objectives for the protection of aquatic life and human health. The water quality objectives in this plan were developed to apply statewide, and they apply to all estuarine waters in the project region. The plan contains objectives for regulating priority toxic pollutants, as listed under the CWA. The EBEP was the subject of a lawsuit brought against the SWRCB, alleging that the plan violated provisions of the Porter–Cologne Water Quality Act and CEQA. On October 15, 1993, a tentative decision was issued that overturned the plan and left the state technically without enforceable numerical objectives for those toxic pollutants regulated in the plan.

After rescission of the plan, the SWRCB and the EPA agreed to pursue a collaborative approach to reestablish the regulatory framework of the EBEP to bring California into compliance with the CWA. The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California is the result of this effort. This State Policy for Water Quality Control, adopted by the SWRCB on March 2, 2000 and effective by May 22, 2000, applies to discharges of toxic pollutants into the inland surface waters, enclosed bays, and estuaries of California subject to regulation under the State's Porter–Cologne Water Quality Control Act (Division 7 of the Water Code) and the federal CWA. Such regulation may occur through the issuance of NPDES permits, the issuance or waiver of WDRs, or other relevant regulatory approaches.

The goal of this policy is to establish a standardized approach for permitting discharges of toxic pollutants to non-ocean surface waters in a manner that promotes statewide consistency. As such, this policy is a tool to be used in conjunction with watershed management approaches and, where appropriate, the development of Total Maximum Daily Loads (TMDLs) to ensure achievement of water quality standards (i.e., water quality criteria or objectives, and the beneficial uses they are intended to protect, as well as the State and federal antidegradation policies).

This Policy establishes implementation provisions for priority pollutant criteria promulgated by the USEPA through the National Toxics Rule and through the California Toxics Rule (CTR), and for priority pollutant objectives established by the RWQCB in its Basin Plan. The CTR was promulgated in May 2000, and the RWQCB is currently preparing amendments to the Basin Plan to incorporate the CTR water quality criteria. The CTR promulgated (1) ambient aquatic life criteria for 23 priority toxics, (2) ambient human health criteria for 57 priority toxics, and (3) a compliance schedule provision that authorizes the state to issue schedules of compliance for new or revised NPDES permit limits based on the federal criteria when certain conditions are met. The state must use these criteria together with the state's existing water quality standards when controlling pollution in inland waters and enclosed bays and estuaries.

California Regional Water Quality Control Board—San Francisco Bay Region

Water quality in streams and aquifers of the region is guided and regulated by the California RWQCB, San Francisco Bay Region. The RWQCB has primary authority for ensuring that water resources are protected from degradation by pollutant discharges. The State Policy for Water Quality Control aims to achieve the highest water quality consistent with the maximum benefit to the people of the state.

To develop water quality standards that are consistent with the uses of a water body, the RWQCB attempts to classify historical, present, and future beneficial uses as part of the Basin Plan. Beneficial uses of the major rivers and groundwater basins, along with narrative and numerical water quality objectives, are established in the Basin Plan for the region (San Francisco Regional Water Quality Control Board 1995). The Basin Plan is periodically reviewed and updated pursuant to PCWQCA.

The USEPA has also promulgated freshwater and saltwater criteria for 126 priority pollutants (13 heavy metals, asbestos, and 112 organic compounds) in the National Toxics Rule. The State of California is currently developing the California Toxics Rule, which would promulgate new water quality criteria for the priority pollutants and supersede the National Toxics Rule in California.

The RWQCB is required to identify water bodies that do not meet water quality objectives pursuant to Section 303(d) of the CWA. Beneficial uses of surface water in the expansion area include municipal and domestic supply; agricultural supply; industrial service supply; groundwater recharge; contact and non-contact recreation; warm, freshwater habitat; cold, freshwater habitat; wildlife habitat; migration of aquatic organisms; and spawning, reproduction, and or early development. Beneficial uses of groundwater throughout the region include municipal and domestic supply, agricultural supply, and industrial service supply.

The Basin Plan has adopted the following objectives, which may apply to the proposed wetland restoration, to protect water resources.

- Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growth causes nuisance or adversely affects beneficial uses.
- Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses.
- Waters shall be free of discoloration that causes nuisance or adversely affects beneficial uses.
- No pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses.
- Discharges shall not result in pesticide concentrations in bottom sediment or aquatic life that adversely affects beneficial uses.

- Persistent chlorinated hydrocarbon pesticides shall not be detectable in water within the accuracy of the analytical methods approved by the USEPA.
- The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
- Waters shall not contain suspended materials in concentrations that cause nuisance or adversely affect beneficial uses.
- Groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses.

The Basin Plan also restricts increases in water temperature and reduction of dissolved oxygen concentrations, especially in water bodies supporting cold-water aquatic organisms.

Discharge of Waste to Land Regulations

The disposal of dredged material to land is regulated by the California Code of Regulations (CCR), Title 23, Division 3, Chapter 15, *Discharge of Waste to Land Regulations*, and is under the authority of the San Francisco RWQCB. Disposal of dredged material to augment existing levees or create upland habitat is considered upland disposal, and project approval by the San Francisco RWQCB would be based on the concentration of constituents of concern in the dredged sediment and site-specific conditions.

Aquatic Disposal of Waste Regulations

Wetland creation using dredged material is considered aquatic disposal under Section 404 of the CWA and is regulated by the California SWRCB and the San Francisco RWQCB under Section 401 of the CWA. The San Francisco RWQCB is responsible for ensuring that water quality objectives in the Basin Plan are not exceeded by a dredged material disposal project. The WDRs issued by the San Francisco RWQCB could require that discharge from a project comply with screening criteria and testing guidelines for wetland creation and upland beneficial reuse to ensure that disposal does not result in degradation of the existing site.

Waste Discharge Requirements

The San Francisco RWQCB establishes WDRs to protect those beneficial uses identified in the Basin Plan. Beneficial uses protected by the Basin Plan that would be applicable to the proposed wetland restoration include wildlife and fish habitat, estuarine habitat, and preservation of rare and endangered species. In establishing WDRs, the San Francisco RWQCB considers the potential impact on beneficial uses within the area of influence of a discharge and the existing quality of receiving waters based on the appropriate water quality objectives.

WDRs issued for a project based on water quality objectives may contain more- or less-restrictive conditions that take into account factors such as economic considerations in addition to actual and potential beneficial uses. Because San Pablo Bay is considered a "water quality limited segment" in the Basin Plan,

more stringent water quality objectives and treatment levels could be required for any discharge to this area. WDRs typically address turbidity, suspended solids, and other water quality issues.

NPDES Storm Water Discharge Permits

In 1992, the SWRCB adopted a General Construction Storm Water Discharge Permit, which requires land owners to file a Notice of Intent to discharge stormwater runoff to waters of the U.S., from land disturbances greater than 5 acres. The permit was reissued in 1999 and modifications made in 2001. The permit generally requires dischargers to eliminate non-stormwater discharges to stormwater systems, develop and implement a stormwater pollution prevention plan, and perform inspections of stormwater pollution prevention measures.

Streambed Alteration Agreement

A Streambed Alteration Agreement (DFG Code 1600 et. seq.) will be required for any work within a creek or stream and its floodplain. Streambed Alteration Agreements, commonly called 1603 Permits, may impose conditions to protect water quality during construction.

Regional Water Quality Conditions

San Pablo Bay is the receiving water for all drainage from the expansion site, including Novato Creek and Pacheco Pond. The Bay receives substantial inflow from the Sacramento and San Joaquin Rivers and smaller amounts of inflow from the Petaluma and Napa Rivers and Sonoma and Novato Creeks. Water quality is maintained by circulation and flushing as a result of tidal action and freshwater inflow. Water quality and salinity in the Bay are determined by the relative mix of these water sources.

In a natural system, surface-water quality depends primarily on the mineral composition of the rocks in the upper source areas of the stream. Farther downstream, the water quality is influenced by the mineral characteristics of the materials through which it flows and by contributions from tributaries. In an urban or developed system such as San Francisco Bay, water quality is also affected by discharges from point and nonpoint sources.

Water quality in San Pablo Bay has been evaluated as part of a study of San Francisco Bay (Aquatic Habitat Institute 1990). Data from the Aquatic Habitat Institute study indicate that levels of some pollutants may be lower than indicated by previous data. However, several pollutants are still present at levels of concern in San Pablo Bay and San Francisco Bay as a whole. Table 4-4 lists waters in the San Pablo Bay region that have been designated as impaired under Section 303(d) of the Clean Water Act and the pollutants for which they were so designated. The designation as impaired can be the result of pollutants, such as heavy metals or pesticides, or a physical property of the water, such as dissolved oxygen or temperature.

The SWRCB is currently revising the 303(d) impaired water body list and plans to release its draft final list on October 15, 2002. In addition to a revision of the formal list, SWRCB is proposing to create a "watch list" for potentially impaired water bodies. Novato Creek is proposed for inclusion on the watch list for sedimentation and siltation concerns. The watch list is intended for RWQCB-identified waters where minimal, contradictory, or anecdotal information suggests standards are not met but either (1) the available data or information are inadequate to draw a conclusion, or (2) a regulatory program is in place to control the pollutant but data are not available to demonstrate that the program is successful. In many cases, the data or information is not of adequate quality and quantity to support a listing under Section 303(d). In these cases, a finding is warranted that water quality appears impacted and more information must be collected to resolve whether standards and beneficial uses are attained. Placement of Novato Creek on this watch list is not a formal designation but requires SWRCB to consider listing the creek in relation to sedimentation and siltation (State Water Resources Control Board 2002).

The water quality in the San Pablo Bay tributaries is influenced by past and present agricultural activities. Sonoma Creek and the Petaluma and Napa Rivers are impaired by sediment, nutrients, and pathogens that are all related to the abundant agricultural activities found in their watershed. The North Bay and San Pablo Bay are also impaired by persistent agricultural chemicals, such as DDT and Chlordane, which may have been used anywhere in the Sacramento and San Joaquin Rivers watersheds. These areas are also impaired by metals and PCB's from past industrial and mining activities. Water quality in the area is further impaired because of mercury, and a health advisory has been issued for the entire San Francisco Bay estuary (California Regional Water Quality Control Board, San Francisco Bay Region 1997) because of mercury levels in aquatic life. Smaller drainages that drain primarily urban areas, such as Novato Creek, are impaired by persistent household insecticides, such as Diazinon.

Table 4-4. Waters in the San Pablo Bay and Tributary to the Bay Listed as Impaired by the San Francisco Bay Regional Water Quality Control Board under Section 303(d) of the Clean Water Act

Water Body/Waterway	Listed Impairment (Pollutant)
San Pablo Bay	Chlordane, DDT, Diazinon, Dieldren, Furan, Dioxin, PCBs, Cu, Hg, Ni, Se, coliform, exotic species
Napa River	Nutrients, Pathogens, Sedimentation/Siltation
Novato Creek	Diazinon
Petaluma River	Nutrients, Pathogens, Sedimentation/Siltation
Sonoma Creek	Nutrients, Pathogens, Sedimentation/Siltation
San Francisco Bay, North	Diazinon, Chlordane, DDT, Dieldren, Dioxin, Furan, PCBs, Cu, Hg, Se, exotic species

Source: State Water Resources Control Board 1999.

In addition to impaired water bodies identified by the SWRCB, the RWQCB has identified toxic hot spots where Bay sediments are contaminated. Table 4-5 lists the toxic hot spots in the San Pablo Bay and the contaminants found at each site.

Table 4-5. Areas in the San Pablo Bay that Have Significant Sediment Contamination

Site	Pollutants Present
Mare Island Naval Shipyard	As, Ag, Cr, Cu, Hg, Zn, TBT, PAHs, PCBs, dieldrin, endrin toxaphene
Hamilton Army Airfield	Cr, Hg, Pb, PAHs, PCBs, DDT, petroleum

Source: San Francisco Regional Water Quality Control Board 1999

The *Hazardous Substances and Waste* section of this chapter discusses in greater detail mercury in San Pablo Bay, Novato Creek, and dredged material, including discussion of sediment screening criteria.

Site-Specific Water Quality Conditions

The existing soil conditions are important in determining water quality at the proposed wetland restoration site. The site is a former tidal salt marsh and mudflat. Soils in this area can affect water quality because of the presence of acid-sulfate soils. These soils have a low pH (high acidity) and are the result of draining the historic salt marsh and the subsequent natural processes that occurred with the oxidation of sediments that had previously been submerged and under anaerobic (oxygen-deprived) conditions. Acid-sulfate soil conditions may affect the quality of runoff because low pH levels can lead to water quality problems, such as release of sulfuric acid, aluminum toxicity and the potential for release of other metals, and fluctuations in nutrient levels.

Urban Runoff

Urban runoff from the adjacent properties is collected by a series of storm sewers and drainage channels to Pacheco Pond and then to Novato Creek. Natural areas have been disturbed over the years by grading and development. Runoff from paved areas is generally rapid. Water quality of runoff from the remaining natural, wooded, or grassy areas is likely to be good. Urban runoff from paved areas and other impervious surfaces can contain a variety of pollutants that can degrade water quality. Pollutants commonly found in urban runoff include heavy metals and petroleum hydrocarbons. The historic discharge of urban runoff from the former HAAF, adjacent to the expansion site, has affected the upper intertidal zone of the salt marsh near the pump station outfall. Elevated levels of metals, including high lead levels, and petroleum hydrocarbons have been found in

sediments in this area. The solvent trichloroethylene and metals have been found in the perimeter drainage channel.

Pacheco Pond

Pacheco Pond receives flow from Arroyo San Jose and Pacheco Creek, as well as stormwater runoff from the Ignacio Business Park. Pacheco Creek, runs through the northwest portion of the former HAAF. Ongoing monitoring of a closed landfill and an MTBE groundwater plume at HAAF, approximately 2,400 feet upgradient of the pond, has not shown migration of contaminants from the landfill or plume in the direction of the pond. The Corps has completed extensive environmental investigations at the airfield and runways and discovered no evidence of other contaminants migrating from HAAF towards Pacheco Pond (San Francisco Regional Water Quality Control Board 2001a).

In 2000 and 2001, there were several reports made to RWQCB of potential water quality problems in the pond. After a report of health problems by local sheriff's divers, RWQCB staff conducted an area-wide search of storm drains and runoff in the vicinity of the pond but did not identify an obvious pollution source. Water samples taken by RWQCB staff in mid December and again in late January detected a low level of MTBE at Pacheco Creek, within its historical concentration range, and benzoic acid at 100 parts per billion in the Pacheco Pond. Benzoic acid is used in the manufacture of cosmetics and creams; it has a half-life of 1 to 10 days in soil and water (San Francisco Regional Water Quality Control Board 2001a).

RWQCB staff received a complaint of a strong sulfur smell and dead fish at Pacheco Pond on April 2001. The complainant indicated that tide gates had been removed between the lower portion of the creek and the pond, causing swift water flows and pond flushing, and reported a milky white suspension of sediment over about three-quarters of the pond, as well as dead insects and fish. Preliminary results of 7 water samples taken by the complainant over a 20-hour period indicated slightly elevated pH in 1 sample and total suspended solids in excess of what is typically observed in stormwater runoff at 2 locations. According to RWQCB, the pH level reflects slight alkalinity but probably not enough to cause adverse effects to humans or wildlife. Sulfides in water were detected on the day following the incident, which is typical of small water bodies with low circulation (San Francisco Regional Water Quality Control Board 2001a).

Between 2000 and 2001, County staff participated in a Baseline Stormwater Program to establish TMDLs in the San Francisco Bay Area. In cooperation with RWQCB and other Bay Area counties, the County staff collected sediment samples at various locations. Samples were taken along Pacheco Creek, storm drain outfalls, and from Pacheco Pond. The sampling effort focused on mercury, PCBs, and organoclorine pesticides (Kinetics Laboratories 2002). Results of the County's sampling revealed concentrations of chlordane and DDT higher than

would typically be expected for ambient levels for North Bay creeks. The highest concentration of chlordane was detected at a storm drain outfall downstream of Ignacio business park and nearby Ignacio trailer park. Concentrations of DDT were highest at a location in Pacheco Creek that is within the boundary of the former HAAF. Although the pesticide concentrations were higher than ambient, they do not reflect levels that would be expected to cause immediate toxicity to fish or aquatic life, according to RWQCB (San Francisco Regional Water Quality Control Board 2001b).

To date, RWQCB has not identified an apparent link between the reported fish kills in spring 2001 and the sediment data received. RWQCB and County staff have identified concerns that lack of aeration and circulation in Pacheco Pond, combined with stormwater runoff, may potentially be reducing dissolved oxygen, thereby causing periodic toxicity. The sulfur odors may also be derived from naturally occurring hydrogen sulfide that accumulates in the sediments and is released during pond flushing (San Francisco Regional Water Quality Control Board 2001b).

In 2002, the Friends of Novato Creek (FNC) submitted a request to RWQCB to list Pacheco Pond as an impaired water body because of its poor water quality resulting from both sediment and pathogens. Contact with RWQCB staff identified that RWQCB has reviewed the FNC request and material submitted, and has determined that listing of Pacheco Pond, as an impaired water body is not warranted at this time. The RWQCB stated that it was aware of the issues related to Pacheco Pond and would continue to observe it for changes in water quality (Moore pers. comm.).

Permitted Discharges

Novato Sanitation District (NSD) discharges treated wastewater through a 54-inch reinforced-concrete pipe into San Pablo Bay. The outfall line follows the boundary between the SLC and HAAF parcels and discharges through a diffuser about 900 feet offshore into the intertidal zone of the Bay. Before the treated wastewater is discharged into the Bay, the NSD dechlorination plant performs final treatment of the wastewater discharge stream. Treated wastewater is discharged only during winter and spring months. During the balance of the year the treated wastewater is recycled and used for irrigation.

Groundwater

The shallow groundwater at the proposed wetland restoration site has a high salinity because of the historic influence of San Pablo Bay. Groundwater is of poor quality and is not used as a potable water source. A deep, higher-quality aquifer is present at an unknown depth. Because of the prevalence of bay muds, runoff is unlikely to recharge the deeper groundwater under the wetland restoration site. Groundwater may be influenced by freshwater levels in Pacheco

Pond and may be less saline near the pond. The general direction of groundwater flow is to the east (Woodward-Clyde 1985). However, the low transmissivity of bay muds greatly reduces the movement of shallow groundwater into San Pablo Bay. Groundwater also discharges to the interior drainage channels and is pumped to San Pablo Bay.

Groundwater quality in the adjacent HAAF and SLC parcels has been affected by contaminants. The main contaminants of concern that have been found in groundwater are petroleum hydrocarbons, such as gasoline and oils, and solvents. These contaminants are discussed in more detail in the *Hazardous Substances and Waste* section of this chapter.

Wetland Water Quality

Wetland water quality is influenced by waterdepth and morphology and the relationship of the wetland to the upstream watershed. The hydrologic regime determines the frequency, depth, and duration of the water's influence on vegetation and the aquatic functions that the wetland provides. Wetlands with little flushing and high nutrient and contaminant loading rates can become stagnant, resulting in low dissolved-oxygen content, decreased aquatic habitat quality, and adverse effects on fish and wildlife. These conditions can also promote excess algal growth and increase mosquito-breeding potential. An adequate supply of fresh water to the wetland improves the capacity for removal of nutrients and contaminants. In a salt marsh environment, adequate tidal flushing maintains good water quality by reducing the potential for development of these conditions.

Wetlands can improve the quality of source waters by decreasing water velocity, inducing sediment deposition, and removing excess nutrients and contaminants. Nutrients and contaminants can adsorb (attach themselves) to sediments in a wetland and be removed by deposition, chemical breakdown, and assimilation into plant and animal tissues.

During wet season months, Novato Creek tends to have freshwater flows due to high runoff conditions in the upstream drainage basin. During summer months, freshwater flows are low or negligible, and most of the water in the creek is from the Bay. Turbidity can be high because of the relatively shallow depths of water and the substantial currents that resuspend bottom sediments. Tidal flows, however, nourish and sustain the salt marsh habitat along the levee at the east end of the proposed wetland restoration site, HAAF, and the SLC parcel adjacent to San Pablo Bay.

Environmental Consequences and Mitigation Measures

Approach and Methods

Water quality effects were evaluated qualitatively based on professional judgement because detailed pollutant transport and fate numerical models are not available. Based on the environmental setting information, all sediments in the Bay are contaminated to some degree by anthropologic activities. Restoration, by natural sedimentation or dredge placement methods, would result in redistribution of Bay sediments and associated pollutants and would result in release of a portion of these pollutants into the overlying water column.

Potential water quality impacts were identified by comparing the proposed wetland restoration alternatives to the applicable laws and regulations regulating water quality in California. The water quality analysis also relies on other sections in this chapter, especially *Geology and Soils, Surface-Water Hydrology and Tidal Hydraulics,* and *Hazardous Substances and Waste.*

Impact Mechanisms

Exceedance of Water Quality Objectives due to Dredged Material Placement Activities

The primary water quality concern associated with placement of dredged material (Alternatives 1 and 2) is the potential for formation of acid-sulfate soils. During the drying process, sulfides formed under anaerobic conditions while submerged are oxidized to sulfate, which then forms sulfuric acid on contact with water from runoff or rain. The acidic conditions and low pH (<5.5) can adversely affect aquatic life and wetland vegetation.

Other water quality issues associated with wetlands created with dredged material include:

- increasing concentrations of sulfide, ammonia, and phosphorus in brackish water and freshwater environments to levels exceeding those permitted by water quality objectives, both in drainage water from recently placed dredged material and in leached runoff after placement; and
- increasing concentrations of heavy metals in drainage water after placement of dredged material as a result of the conversion of soil chemistry from anaerobic (reducing) to aerobic (oxidizing) conditions, which increases the dissolved, readily soluble concentration of many heavy metals.

Dredged material could contain contaminants and other chemical constituents that pose a threat to water quality. There are several upland and aquatic

pathways by which contaminants can threaten water quality in a wetland environment. The contaminant pathways are:

- effluent discharge;
- runoff;
- leachate runoff;
- seepage by soluble diffusion and soluble convection through tidal pumping and capillary action; and
- bioturbation, which includes the physical and biological activities that occur at or near the sediment surface that cause the sediment to become mixed.

These pathways also indicate the biotic resources potentially affected by the mobilization and accumulation of toxic contaminants. Water quality degradation could occur initially in surface water that comes into contact with levees or wetland slopes. As seepage of surface water and leachate from sediment occurs, degradation of shallow groundwater could also occur.

Dredged sediment with chemical concentrations less than the concentrations listed in the *Hazardous Substances and Waste* section is acceptable for potential use in all wetland creation projects at any depth within the wetland (Wolfenden and Carlin 1992). Dredged material at lower concentrations is also acceptable for levee restoration and maintenance, landfill daily cover, and upland creation. The BMKV expansion would accept only dredged material that meets cover-material criteria.

Exceedance of Water Quality Objectives due to Natural Sedimentation Restoration Strategies

Water quality issues associated with wetlands created without dredged material (Alternative 3) are related to maintaining adequate flow and circulation. The hydrologic regime determines the frequency, depth, and duration of the water's influence on vegetation and the aquatic functions that the wetland provides. Wetlands with little flushing and high nutrient and contaminant loading rates can become stagnant, resulting in depressed dissolved-oxygen content, decreased aquatic habitat quality, and adverse effects on fish and wildlife. These conditions can also promote excess algal growth, generate noxious odors, and increase mosquito-breeding potential.

Exceedance of Water Quality Objectives due to Wetland Creation

Mercury has been introduced as a contaminant into the San Francisco Bay environment in various chemical forms from a variety of anthropogenic sources.

In the San Pablo Bay specifically, mercury was introduced from gold mining in the Sierra Nevada

Although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into extremely toxic methylmercury. Monomethylmercury is reported as the most bioavailable and biologically persistent form of mercury and is known to work its way up the food chain to cause serious illness and death in humans. The largest contributors of methylmercury in the environment appear to be sulfate-reducing bacteria, which occupy the anoxic sediment just below the sediment-water interface in water bodies and salt marshes.

Disturbance of mercury-contaminated sediments that were previously sequestered in biologically unavailable deep sediments has the potential to release mercury bound to sediments and sulfides. In addition, oxidizing conditions that occur during placement of materials can cause mercury and sediments to be released into overlying waters. Once released these mercury cations become biologically available for mercury-methylating bacteria. The resultant concentration of methylmercury is dependent on numerous variables: salinity, pH, vegetation, sulfur concentration, dissolved organic carbon, ox/redox, and seasonal variations in each of the identified variables.

Exceedance of Water Quality Objectives due to Spillage Associated with Diesel Off-Loading and Booster Pumps

Diesel fuel may be spilled if diesel off-loading and booster pumps are used to pump dredged material from the off-loader onshore.

Exceedance of Water Quality Objectives due to Changes in Circulation of Pacheco Pond

The restoration alternatives include diversion of some or all of Pacheco Pond outlet flows from Novato Creek to the restoration site. Each alternative also includes expansion of Pacheco Pond. These changes may change circulation in Pacheco Pond, which may affect water quality.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding water quality, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- violate any water quality standards or waste discharge requirements,
- substantially degrade surface water and/or groundwater quality,

- contaminate a public water supply,
- substantially increase suspended solids in and turbidity in receiving waters, or
- discharge contaminants into the waters of the United States.

Impacts and Mitigation Measures of No-Action Alternative

Under the No-Action Alternative, the proposed wetland restoration site would remain in its present condition and drainage facilities would continue to be operated and maintained by the owner. Therefore, the No-Action Alternative would have no water quality effects.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact WQ-1: Potential for Degradation of Surface Water and Sediment Quality due to Increased Methylmercury Formation Potential

As previously described, mercury has been introduced as a contaminant into the San Francisco Bay environment in various chemical forms from a variety of anthropogenic sources.

Although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into extremely toxic methylmercury. Monomethylmercury is reported as the most bioavailable and biologically persistent form of mercury and is know to work its way up the food chain to cause serious illness and death in humans. The largest contributors of methylmercury in the environment appear to be sulfate-reducing bacteria, which occupy the anoxic sediment just below the sediment–water interface in salt marshes.

Natural accretion processes in salt marshes continually supply fresh layers of sediment that release mercury cations and provide the environment for the methylation process. Once released, these mercury cations become biologically available for mercury-methylating bacteria. The resultant concentration of methylmercury is dependent on numerous variables: salinity, pH, vegetation, sulfur concentration, dissolved organic carbon, ox/redox, and seasonal variations in each of the identified variables.

Although it is likely that mercury methylation would increase as a result of the dredged placement approach, it is not clear whether the act of placement causes

more notable effects than the natural methylation processes. As discussed in the *Hazardous Substances and Waste* section of this chapter, in addition to dredged material placement, sediment from Novato Creek or San Pablo Bay may also provide a source of mercury that may be methylated in the restored wetland area. It is also not currently possible, although models are being developed, to estimate the methylmercury concentrations and bioaccumulation and biomagnification in the food chain. Because a clear conclusion cannot be made regarding the potential for a significant adverse effect on the environment, this impact is considered significant and unavoidable. To minimize this effect, the following mitigation measure should be implemented.

Mitigation Measure WQ-1: Implement Methylmercury Adaptive Management Plan.

An adaptive management plan will be developed and implemented to address methylmercury production and accumulation in the restoration site. The plan should be developed in consultation with the responsible regulatory agencies (RWQCB, BCDC, Corps, NMFS, USFWS, federal EPA, DFG, etc.). Staff of these agencies should be part of the adaptive management team to guide development of the plan; determine the duration, frequency of monitoring, constituents to be monitored, and monitoring protocols; and develop corrective actions as needed to minimize the adverse effects of methylmercury.

As noted above, water quality models are currently being developed to evaluate methylmercury concentrations. Once appropriate models are developed and adopted, they will be used to help develop the proposed methylmercury adaptive management plan.

Key elements of this plan would include water- and sediment-quality monitoring, hydrodynamic monitoring, and benthic invertebrate monitoring. Monitoring would be conducted for at least 10 years post-breach. The purpose of the monitoring would be to determine whether methylmercury concentrations are found at substantially greater concentrations in the water column, sediments, or benthic invertebrate population at the restoration site than at reference sites.

Although it is generally thought that restoring large areas of salt marsh throughout the San Francisco Bay region is beneficial to the environment, large-scale restoration projects could expose populations of special-status species to methylmercury for many years. In addition, there is a potential for human health risks should increased production of methylmercury occur that results in increased mercury concentrations in fished species. The likely outcome of the adaptive management plan will be informed decision making that will guide the phased restoration of salt marshes throughout the San Francisco Bay.

Impact WQ-2: Potential Degradation of Groundwater Quality

Inundation of the expansion area could degrade shallow groundwater through saltwater intrusion or leaching of hazardous materials. However, the shallow groundwater in the expansion area already has a high salinity because of the historic influence of San Pablo Bay. Because of the presence of bay muds at the site, surface water and shallow groundwater are unlikely to recharge deeper groundwater. Saltwater intrusion and leaching of hazardous materials are therefore unlikely to occur. This impact is considered less than significant, and no mitigation is required.

Impact WQ-3: Potential for Degradation of Water Quality in Restored Wetlands from NSD Discharges

NSD seasonally discharges treated wastewater to the intertidal zone of San Pablo Bay. The overall NSD discharge flow rate is approximately 0.01% of the average tidal flow discharge in San Pablo Bay. Diffusion and mixing by the tidal and wind-driven circulation in the Bay provide ample opportunity for dilution of the wastewater discharge stream. Because of the high degree of dilution that the discharge stream undergoes upon release into San Pablo Bay and the relative separation of the diffuser from the entrance channels of the proposed tidal wetlands, the impact of return flows from the NSD facilities entering the proposed tidal wetlands is considered less than significant, and no mitigation is required.

Impact WQ-4: Beneficial Increases in Dissolved Oxygen Concentration in Receiving Waters.

Increasing the water surface of the Bay increases the potential gas exchange rate with the atmosphere, which would result in an increase in dissolved oxygen concentration in the Bay. Increased dissolved oxygen would increase the productivity of lowest levels of the food chain. Increased productivity would benefit all higher trophic-level organisms, such as anadromous fish (salmon and steelhead), resident fish, and piscivorous birds. Therefore this effect is considered a beneficial impact on the environment.

Impact WQ-5: Potential Exceedance of Water Quality Objectives due to Inadequate Flushing in Restored Wetlands

As described above under *Impact Mechanisms*, implementation of the proposed wetland restoration could create a water body with inadequate freshwater or tidal flushing and result in stagnation, resulting in depressed dissolved-oxygen concentrations and algal blooms. Assuming adequate flow and the absence of

hazardous materials, water quality in created wetlands would probably be similar to that of incoming water sources such as Novato Creek, Pacheco Creek, and San Pablo Bay. This impact is considered less than significant, and no mitigation is required.

Impact WQ-6: Potential Diesel Pump Spills into San Pablo Bay

Operation and fueling of the diesel off-loading and booster pumps could result in spills of diesel into San Pablo Bay. This impact is considered significant, and the following mitigation should be implemented to mitigate this impact to a less-than-significant level.

Mitigation Measure WQ-2: Provide for Spill Protection at Off-Loader and at Booster-Pump Facility.
Design of the off-loader will include spill curtains, double-containment, or other design measures to reduce the potential for diesel fuel or engine oil to enter San Pablo Bay during pump operation, fueling, or maintenance. Institutional controls, such as adoption of a safety plan, will also be implemented to further provide spill protection.

Impact WQ-7: Potential for Changes in Salinity Levels within Novato Creek

Diverting some or all of the existing outlet that flows from Pacheco Pond to Novato Creek could lead to changes in the salinity levels in Novato Creek. Under existing conditions, there is minimal discharge from Pacheco Pond, which is turn is limited by a tide gate that is located between the outlet channel and Novato Creek. During low-flow summer conditions, the flow from Pacheco Pond is minimal compared to the daily tidal prism on Novato Creek, and salinity levels within the creek are controlled by San Pablo Bay. During high flow conditions (i.e., during a storm event), overflows from Pacheco Pond and higher flows from Novato Creek push any saline waters out to the Bay. As soon as a storm event is over and high flows subside, salinity levels within the creek return to the background salinity of San Pablo Bay. The addition of freshwater from Pacheco Pond likely has a negligible effect on the salinity levels of Novato Creek because the resulting high flows from a storm event already cause a change in the creek's salinity levels due to an influx of freshwater flows. Pacheco Pond would add a few more hours, at most, of freshwater outflow to the creek during a storm event. The impact of diverting some or all of the outlet flows is thus considered less than significant.

Impact WQ-8: Potential Changes to Circulation in Pacheco Pond

RWQCB and County staff have identified that low circulation in Pacheco Pond combined with high summer temperatures could cause excess algal growth, leading to a reduction in the amount of dissolved oxygen in the water. This may be the cause of recent reported water quality problems in the pond (City of Novato 2001; San Francisco Regional Water Quality Control Board 2001a, 2001b).

Implementation of the alternatives would result in redirection of some or all of the existing pond outlet flows to the restoration site in the wet season. In dry season, drainage would be as at present, through the existing outlet to Novato Creek. Development and implementation of a new water management plan for the pond, in cooperation with MCFCWCD and CDFG, is included as part of the project. If the outlet invert were set at the existing pond target elevation of 1.5 feet NGVD (as described in the conceptual design in chapter 3), then managed elevations of the pond would not change, thereby avoiding expansion of shallow portions of the pond that could otherwise exacerbate algal growth. If the outlet invert were set at elevations lower than the current target elevation, then the project could result in an expansion of shallow portions of the pond.

Under each alternative, the design feature for Pacheco Pond includes an expanded pond. A larger volume of water could be more susceptible to wave action and thus enhance wind-derived circulation. However, in the dry season when temperatures are high and the pond receives limited inflow, the proposed expansion in pond volume, with no change in inflow, could exacerbate low dissolved-oxygen levels. Some or all of the flow would be diverted during the wet season, but water would not be diverted from the pond during the the dry season. Because the changes included under the alternatives have the potential to exacerbate apparent water quality conditions in Pacheco Pond, this impact is considered significant. The following mitigation is recommended to reduce this impact to less than significant.

Mitigation Measure WQ-3: Incorporate Pacheco Pond Water Quality Concerns Regarding Circulation in New Water Management Plan, in Cooperation with MCFCWCD and CDFG.

Water quality considerations regarding circulation will be taken into account during development of the new water management plan. MCFCWCD, in cooperation with CDFG and the Conservancy, Corps, or their successor in interest, will develop a water quality management plan for Pacheco Pond prior to commencement of restoration activities. This plan will need to take into account the changes in pond outlet flows, construction of a new pond outlet, and potential expansion of the pond. The plan will also take into account water quality concerns regarding circulation and may require additional studies of the circulation of the pond prior to establishing appropriate outlet design to BMKV and prior to establishing operating procedures. The plan will be developed in conjunction with final design of the wetland restoration project.

Impacts Common to Alternative 1 and Revised Alternative 2

Impact WQ-9: Potential for Degradation of Receiving Water Quality due to Dredged Material Placement

Construction of the restoration site using the dredged placement approach would include hydraulic placement of fill material. Dredged material would be pumped with water, as a slurry, from barges in the Bay to the restoration site. Once in the restoration site, the solids in the slurry would settle, and new slurry would be added. The surplus water would need to be pumped out of the restoration area and disposed of in the Bay. This surplus water, depending on the detention time, could have substantial concentrations of fines that would degrade the receiving waters by increasing the suspended solids and turbidity. Increases in suspended sediments and turbidity in the receiving waters is considered a significant impact. To reduce this impact to a less-than-significant level, Mitigation Measure WQ-3, described below, would be implemented.

Placement of dredged sediments would result in the saturation of existing acid-sulfate soils. Such conditions could affect the quality of runoff from the active construction area because of the low pH levels. The water quality problems associated with low pH include release of sulfuric acid, aluminum toxicity and the potential for release of other metals, and fluctuations in nutrient levels. These constituents could be discharged to San Pablo Bay or leach through onsite soils to groundwater. However, the procedure used to create wetlands (i.e. drainage into a water quality detention pond prior to discharge) would greatly dilute the small amount of sulfuric acid that could be released. Therefore this impact is considered less than significant.

The proposed BMKV expansion could also result in potential leaching of contaminants from dredged sediments, physical erosion and transport of the sediment by surface water currents and runoff, and selective uptake and biomagnification of contaminants in plants and animals. However, the sediments selected for use as cover material for tidal and seasonal wetland restoration at the expansion site would need to meet the RWQCB screening criteria, which would minimize the potential for bioaccumulation. Maintaining wet, anoxic sediment conditions would minimize pH changes and increases in leachability of heavy metals and other substances. Restricting disposal of sediments to those passing the cover screening criteria would ensure that no adverse impacts on surface-water quality would occur. This would be enhanced by the site design, which would promote sedimentation as a physical sink for incoming tidal sediment. Therefore, this impact is considered less than significant.

After the perimeter levee has been breached and full tidal circulation has been restored across the site, some of the dredged material would be remobilized. Tidal flows and velocities at the perimeter levee breach locations would increase localized erosion in the existing tidal slough channels and bordering marsh.

Remobilization of the dredged material by tidal currents and wind-generated waves across the open fetches of the site would increase local turbidity and sedimentation until the eroded material is redeposited. No substantial offsite transport is anticipated. The impacts of increased turbidity and sedimentation would be short term, and offsite transport would eventually be eliminated when equilibrium is established in the restored tidal marsh and tidal sloughs. This localized, short-term impact is considered less than significant because high turbidity is characteristic of the water in dynamic tidal marsh environments.

Mitigation Measure WQ-4: Develop and Implement Water Quality Monitoring Program for Dredged Material Placement.
A water quality monitoring program will be developed and implemented to ensure adequate protection for aquatic life. Before the construction phase is initiated, water quality monitoring and reporting requirements for the proposed BMKV expansion will be established by the San Francisco RWQCB in project-specific WDRs in accordance with the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California. The WDRs will likely require sampling and analysis to provide background water quality information on the project's discharge. The data will be used to evaluate water quality of the discharge and determine compliance with the WDRs. Monitoring and reporting requirements will be based on site-specific conditions, such as beneficial uses, existing water quality, quality of dredged material, and wetland management goals.

The monitoring program will be initiated before implementation of the proposed BMKV expansion to determine background concentrations of constituents of concern, and will continue during construction to identify any adverse impacts.

After placement of dredged material, water samples should be collected and analyzed at frequencies ranging from monthly to quarterly and during both high and low tides. Monitoring frequency may be reduced if data indicate that the created wetland is in compliance with WDRs and is not adversely affecting water quality. During dredged material placement, periodic monitoring should be required for key constituents of concern, such as nitrate, ammonia, phosphorus, and heavy metals. Other water quality parameters to be monitored include salinity, temperature, pH, dissolved oxygen, and suspended solids.

Exceedance of monitoring standards may require temporary delays in material placement or the installation of turbidity curtains or other physical measures to control the flow of water and sediments. See separate discussion of methylmercury in Impact WQ-1 above.

Impacts Unique to Alternative 3

Impact WQ-10: Potential for Spills from Fueling of Pump(s) at Pump Station

Operation and fueling of the relief pump(s) at the pump station for relief of high water (above 1.5' NGVD) in the BMK south lagoon could result in spills of diesel into Novato Creek, San Pablo Bay or the south lagoon. The specific design of the pump(s) has not been conducted, thus it is unknown if they would be electric or diesel. However, assuming they are diesel (or that at least a backup pump is diesel), fueling and operation could result in release of diesel fuel to the surrounding areas. This impact is considered significant, and if Alternative 3 were selected, the following mitigation should be implemented to mitigate this impact to a less-than-significant level.

Mitigation Measure WQ-5: Provide for Spill Protection at Pump Station.

Design of the pump station should include spill curtains, double-containment, or other design measures to reduce the potential for diesel fuel or engine oil to enter surrounding water bodies during pump operation, fueling, or maintenance. Institutional controls, such as adoption of a safety plan, should also be implemented to further provide spill protection.

Public Health

This section addresses the public health effects of implementing the proposed BMKV expansion. Because of the potential for mosquito-borne disease, the analysis focuses on the creation of potential breeding habitat for mosquitoes.

Affected Environment

Data Sources

Information presented in this section is based on the following data sources.

- *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998)
- *Environmental Analysis of Tidal Marsh Restoration in San Francisco Bay* (San Francisco International Airport 2001)

Mosquito Breeding Conditions

Mosquitoes require standing water to complete their growth cycle. Any body of standing water represents a potential breeding site for mosquitoes, with the exception of ponded areas that are flushed daily by tidal action. These areas are highly saline in nature and are not stagnant for a long enough period of time to support the mosquito larvae to maturity (Tietze 2001).

Water quality affects the productivity of a potential breeding site for mosquitoes. Typically, greater numbers of mosquitoes are produced in water bodies with poor circulation, higher temperatures, and higher organic content than in water bodies having good circulation, lower temperatures, and lower organic content (Collins and Resh 1989). In addition, irrigation and flooding practices may influence the level of mosquito production associated with a water body. Typically, greater numbers of mosquitoes are produced in water bodies with water levels that slowly increase or recede than in water bodies with rapidly fluctuating water levels (Jones & Stokes Associates 1996).

Mosquito larvae flourish in stagnant water, particularly in small, protected microhabitats provided by stems of emergent vegetation. Therefore, if not properly maintained, ditches can be major producers of mosquitoes. Periodic dredging of ditches substantially reduces mosquito production by enhancing water circulation and preventing encroachment of emergent vegetation into ditch channels. Mosquitoes are adapted to breed during periods of temporary flooding and can complete their life cycles before water evaporates and predator populations become well established. Poor drainage conditions that result in ponding water, and water management practices associated with agriculture and

creation of seasonal wetlands for waterfowl use result in the types of flooding that can produce problem numbers of mosquitoes (Jones & Stokes Associates 1996).

Permanent bodies of open water that have good circulation, low temperatures, and low organic content typically sustain stable nutrient content and support rich floral and faunal species diversity, including mosquito predators and pathogens. In addition, wave action across large bodies of water physically retards mosquito production by inhibiting egg laying and larval survival (Jones & Stokes Associates 1996).

There are 2 broad types of mosquito production sources present in the expansion area: habitats where water ponds permanently, and habitats where water ponds seasonally. Within the expansion area, water ponds permanently in portions of the drainage ditches on the BMKV site. Habitats that seasonally pond water in the expansion area include brackish marsh, seasonal wetlands, agricultural drainage ditches, and portions of cultivated fields that may pond water during the wet season. Table 4-6 shows the estimated acreages of potential mosquito breeding habitat in these areas. Within these areas, local suitability likely varies, depending on the extent and duration of ponding and on site-specific salinities and water currents.

Table 4-6. Estimated Acreages of Potential Existing and Post-Restoration Mosquito Breeding Habitat in the Expansion Area

Habitat Type	Existing Habitat	Alternative 1	Revised Alternative 2	Alternative 3
Cultivated Fields (ponded areas within habitat	1,241	-	-	-
Brackish Drainage Ditches	36	-	-	-
Grassland (ponded areas within habitat)	129[1]			55[1]
Seasonal Wetland	114	40	277	
Nontidal Salt Marsh	21	-	-	-
High Transitional Marsh	-	160	79	30
Open Water	15	40	21	40
Freshwater Emergent Wetland	-	10	12	10
Total	1,556	550	389	135

[1]Existing grasslands are low lying with poor drainage; upland/grassland areas in Alternatives 1 and Revised Alternative 2 would be sloped to facilitate drainage.

Marin–Sonoma Mosquito Abatement District

The expansion area is located within the jurisdiction of the Marin–Sonoma Mosquito Abatement District (MSMAD). Mosquito abatement districts (MADs) are governmental organizations formed at the local level that are responsible for controlling specific disease vectors within their jurisdiction. MADs receive most of their revenue from property taxes and are primarily responsible for controlling mosquitoes as pest species and as disease vectors. California law requires that if a problem source of mosquito production exists as a result of human-made conditions, the party responsible for those conditions are liable for the cost of abatement. The law is enforced at the discretion of the responsible MAD (California Health and Safety Code Section 2200 et seq.).

Although MADs do not have jurisdiction on state and federal lands, the Conservancy would coordinate with MSMAD to ensure that the proposed BMKV expansion does not create public health effects associated with the creation of new wetland habitat.

Criteria for Determining the Need for Control at a Mosquito Source

State laws and regulations require that mosquitoes be controlled if diseases transmitted by mosquitoes are identified in or near human populations, or if surveillance of mosquito populations for the incidence of mosquito-transmitted diseases indicates the likelihood of transmission (Jones & Stokes Associates 1996). The decision to control mosquitoes as a nuisance to human populations is at the discretion of each MAD. Factors influencing this decision may include the number of service calls received from a given locality, the proximity of mosquito sources to population centers, the availability of funds for abatement, the density of mosquito larvae present in a mosquito production source, and the number of adult mosquitoes captured per night in light traps (Jones & Stokes Associates 1996). Once a recurring mosquito production source has been identified, abatement schedules are often adopted and maintained for that source (Jones & Stokes Associates 1996).

Mosquito Control Methods

To reduce mosquito populations, MADs use a combination of various abatement procedures, each of which may have maximum effectiveness under specific habitat conditions or periods of the mosquito life cycle (Jones & Stokes Associates 1996). Mosquito control methods used by MADs include use of biological agents (e.g., mosquitofish, which are predators on mosquito larvae) in mosquito breeding areas, source reductions (e.g., drainage of water bodies that produce mosquitoes), pesticides, and ecological manipulations of mosquito breeding habitat.

Mosquito Habitat Conditions and Abatement Requirements for the Expansion Area

MSMAD abatement efforts in the expansion area are primarily focused on controlling mosquitoes that can transmit malaria and several types of encephalitis, or cause a substantial nuisance in surrounding communities. Of the wetland habitats in the expansion area, seasonal wetlands, brackish drainage ditches, and ponded areas within cultivated fields are considered to have the potential to produce problem numbers of mosquitoes that may act as vectors for diseases in the area. Table 4-6 summarizes the acreages of those habitats at the BMKV site with the potential to produce problem numbers of mosquitoes.

Environmental Consequences and Mitigation Measures

Approach and Methods

Changes in mosquito abatement requirements for the expansion area were evaluated through a comparison of existing potential mosquito habitat with post-restoration potential mosquito habitat.

Impact Mechanisms

Impact mechanisms include conversion of areas that do not currently provide breeding habitat for problem numbers of mosquitoes (e.g., grasslands and developed areas) to wetland habitats that have characteristics suitable for producing problem numbers of mosquitoes, and changes in water management practices resulting from implementation of the restoration alternatives.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding public health, the proposed expansion was identified as resulting in a significant impact on the environment if it would result in habitat changes that would necessitate increasing levels of mosquito abatement programs to maintain mosquito populations at pre-construction levels. Habitat changes that could result in a substantial decline of available mosquito breeding habitat or greater efficiency of MSMAD's abatement program would be considered beneficial impacts.

Impacts and Mitigation Measures of the No-Action Alternative

No impacts on the level of mosquito production or MSMAD's abatement program would occur under the No-Action Alternative because the expansion area would remain under the existing conditions, and no change in the current level of service provided by the MSMAD would occur.

Impacts and Mitigation Measures Common to Alternatives 1–3

The public health impacts described below are common to all 3 alternatives.

Impact PH-1: Increase of Potential Mosquito Breeding Habitat

Approximately 550, 389, and 135 acres of potential mosquito habitat would be created with implementation of Alternative 1, Revised Alternative 2, and Alternative 3, respectively. However, these acreages represent a decrease in potential mosquito breeding habitat from the existing conditions on the expansion site, depending on the ponding potential of the cultivated fields currently onsite. During construction but before the perimeter levee is breached to establish tidal flow to portions of the site, surface water may pond in depressions created in portions of the work site as a result of excavation, filling, and grading activities. Areas that pond water for periods sufficient to allow production of adult mosquitoes could also provide temporary suitable habitat for mosquito production. Overall, a decrease in mosquito production would likely occur with implementation of Alternative 1, Revised Alternative 2, or Alternative 3. This would be a beneficial impact. Nevertheless, the following mitigation measure is recommended to ensure that suitable habitat for mosquito production remains controlled and properly regulated throughout construction and implementation.

Mitigation Measure PH-1: Coordinate Restoration Design and Expansion Activities with MSMAD.

The Conservancy and the Corps will consult and coordinate with MSMAD during design, implementation, and operations phases of the expansion. The Conservancy will be responsible for coordination with MSMAD regarding mosquito control measures for the expansion area following completion of construction. Consultation and coordination with MSMAD will include:

- development and implementation of water management strategies that reduce site suitability for mosquito breeding;
- air and ground applications of Bti (*Bacillus thurigiensis* var. *israelensis*), methoprene growth regulators, or other EPA-approved pesticides, as needed; and
- consultation with MSMAD to perform ongoing monitoring of larval and adult mosquito populations, water quality, and vegetation density, and to implement control and management measures under the authority of MSMAD.

Biological Resources

Biological resources evaluated for the proposed alternatives include native and non-native aquatic and terrestrial habitats, special-status communities, special-status plant and animal species, and species groups of high recreational interest. This section describes existing biological resources present in the proposed expansion area and potential impacts on biological resources that may occur with implementation of the restoration alternatives.

Since the alternatives call for restoration of habitats, the description of site habitats also provides an estimate of some of the habitat functions and values that would be provided upon maturity of the habitats proposed for restoration to the BMKV site. As noted in the impact assessment below, the context of the proposed project as a restoration project designed to establish tidal wetland, seasonal wetland, and other habitat components on the site was taken into account when evaluating the significance of impacts on the existing biological setting.

Affected Environment

Data Sources

Information presented in this section is based on the following data sources.

- *Bel Marin Keys Unit V Final Environmental Impact Report/Environmental Impact Statement* (Environmental Science Associates 1993)
- *Delineation of Clean Water Act Jurisdiction on Proposed Bel Marin Keys Project Site, Novato, CA* (LSA Associates 1997)
- *Special-Status Plant Surveys and Terrestrial Habitat Characterization of Four Mitigation Complexes, San Francisco Airport Expansion Project* (May & Associates 2001)
- *Hamilton Wetland Restoration Plan Final Environmental Impact Report/Environmental Impact Statement* (Jones & Stokes 1998)

Common and scientific names of plant and animal species mentioned in the text are presented in table D-1 in appendix D.

San Pablo Bay (Regional Setting)

The project site is located on the northwestern shore of San Pablo Bay. The San Pablo Baylands area (including the project site) is composed of several types of habitats that are important to estuary plant and wildlife species, including

subtidal channels, intertidal mudflats, tidal wetlands and sloughs (including tidal salt marsh and tidal brackish marsh), diked historic baylands (including farmed wetlands, seasonal wetlands, salt ponds, managed wetlands, and freshwater marshes), streams and creeks (like the Petaluma River, Novato Creek, and Gallinas Creek), and upland areas. As noted in chapter 2, development has altered the habitats found in the baylands dramatically. The specific bayland habitats found in and directly adjacent to the BMKV site are discussed in further detail below.

San Pablo Bay (Open Water Habitat)

The following discussion of open water habitats is from the *Baylands Ecosystem Habitat Goals Report* (Goals Project 1999). Bay habitats are tied to the baylands and are components of the baylands ecosystem. They are important for aquatic organisms, sea birds, and some mammals that move back and forth between deep and shallow waters. Bay habitats are divided into 2 categories: areas of deep water (deep bays) and areas of shallow water (shallow bays and channels).

The only parts of the project characterized as deep bays are the parts of the project area that are deeper than 18 feet below MLLW. These are the easternmost portions of the off-loading pipeline and the off-loading facility itself. The sediments of deep bay and channel habitat vary widely in character, from coarse sand to very fine clays and silts. In the parts of the Bay where currents are strong, especially as in the deeper reaches of San Pablo Bay, the bottom is mostly coarse sand. Deep bays and channels are important for aquatic invertebrates, including California bay shrimp, Dungeness crab, and rock crab, and for fish such as white sturgeon and brown rockfish. They also are migratory corridors through which pass anadromous fish, including chinook salmon and steelhead. Deep bays and channels are habitat for several species of water birds, including brown pelican, double-crested cormorant, greater and lesser scaup, surf scoter, and Caspian tern. Marine mammals such as harbor seal and California sea lion are also utilize this habitat.

Shallow bays and channels include the portion of the project area where the bottom is entirely between 18 feet below MLLW and MLLW. The sediments of shallow bays and channels are primarily mud. Shallow bays and channels are important for many invertebrates, fish, and water birds. This rich environment is an especially productive feeding area for many fish, including splittail, northern anchovy, and jacksmelt. It is also an important migratory corridor for anadromous fish such as chinook salmon and steelhead. A few of the many bird species that occur in this habitat include western grebe, American wigeon, canvasback, Forster's tern, and least tern. Harbor seals and sea lions also utilize this habitat.

Biological Communities–BMKV Expansion Site

The habitats present at the proposed BMKV expansion site and immediately adjacent include aquatic, wetland, and grassland communities and developed areas. A substantial portion of the expansion site is agricultural land. These habitats and the plant and wildlife species associated with the BMKV site are described below. The biological setting in and around Pacheco Pond is described separately. The distribution of habitat types within each area is presented in figure 4-8, and the acreage of each habitat type in each area at BMKV is presented in table 4-7. Habitat types and acreages are derived from the results of previous habitat inventories of the expansion area.

Aquatic Communities

Aquatic communities found in the expansion area immediately outside of the BMKV perimeter levees include subtidal aquatic (i.e., aquatic habitats that are never exposed during low tide), intertidal aquatic (i.e., emergent marsh habitat and mudflats that are exposed during low tides). In addition there are brackish open water habitats on the BMKV site in the drainage ditches and in one borrow pit. Each of these is described below. A schematic of typical aquatic habitats by tide levels is provided in figure 4-9.

Subtidal Aquatic Habitat

Subtidal aquatic habitat is located adjacent to the site in the deeper parts of Novato Creek and San Pablo Bay. Subtidal aquatic habitats are areas of continuous open water that are submerged during even the lowest tide; as a result, these areas are too deep to support the types of vegetation found in emergent (i.e., occasionally exposed) marsh habitat. Phytoplankton; zooplankton; and fish, such as longfin smelt, northern anchovy, speckled sand dab and staghorn sculpin, occupy subtidal aquatic habitat. Benthic (bottom-feeding) organisms such as worms and clams can be found in the sandy, muddy bottom. Many species of waterfowl and diving birds use subtidal aquatic habitat for feeding areas.

Intertidal Aquatic Habitat

Intertidal aquatic habitat is located adjacent to the site along the Novato Creek channel and outboard of the San Pablo Bay perimeter levee. Intertidal aquatic habitat comprises 2 subtypes of habitat: intertidal mudflats, and coastal salt marsh. Intertidal mudflats are made up of unconsolidated, muddy bottom areas without vegetation and are present along coastal salt marshes that are outboard of the perimeter levee. Mudflats are exposed twice daily during low tide and extend to the extreme low water elevation (figure 4-9). Narrow bands of mudflat are also found at the same elevations along the margins of subtidal channels in tidal marshes. Mudflats are highly productive and support large populations of benthic organisms, including aquatic worms, crustaceans, and mollusks, that are important elements of the estuarine food web. When exposed or covered by shallow water, mudflats provide important foraging areas for migrant and wintering shorebirds, wading birds, and gulls.

Table 4-7. Estimated Extent of Habitat Types (Acres) Present in the BMKV Site under the No-Action Alternative and Alternatives 1–3 at Year 50 after Project Implementation, and the Net Change in Extent of Habitat Types Restored Under the Project Alternatives from the No-Action Alternative

	No-Action Alternative (i.e., Existing Conditions)	Alternative 1		Alternative 2		Alternative 3	
Habitat Type	Acres	Acres	Net Change	Acres	Net Change	Acres	Net Change
Coastal Salt Marsh (Tidal)	18[a]	1039[e]	+1021	899[e]	+882	1274[e]	+1256
Coastal Salt Marsh (Nontidal)	21[b]	.0	-21	0	-21	0	-21
Tidal and Subtidal Channels	2	147	+145	120	+118	197	+195
Brackish Open Water and Emergent Marsh	63[c]	50[f]	-13	33	-30	50[f]	-2
Seasonal Wetland	114[d]	40	-74	277	+162	10	-104
Grassland (Upland)	129	300	+171	247	+119	45	-844
Agriculture (Non-Ponding)	1079	0	-1079	0	-1079	0	-1079
Agriculture (Ponding)	151	0	-151	0	-151	0	-151
Total	1576	1576	0	1576	0	1576	0

[a] Includes 17.5 acres of tidal marsh outside of levees
[b] Includes 5.8 acres of saline seeps and approx. 15 acres in Borrow Pits B and C
[c] Includes 36.0 acres of drainage ditches and approx. 15.5 acres in Borrow Pit A
[d] Includes 10.5 acres in western field, 24.9 acres in borrow pit field, and 79.0 acres in dredge spoil disposal field
[e] Includes low marsh, tidal marsh, and high transitional marsh
[f] Includes 40 acres of expanded Pacheco Pond and 10 acres of emergent marsh habitat

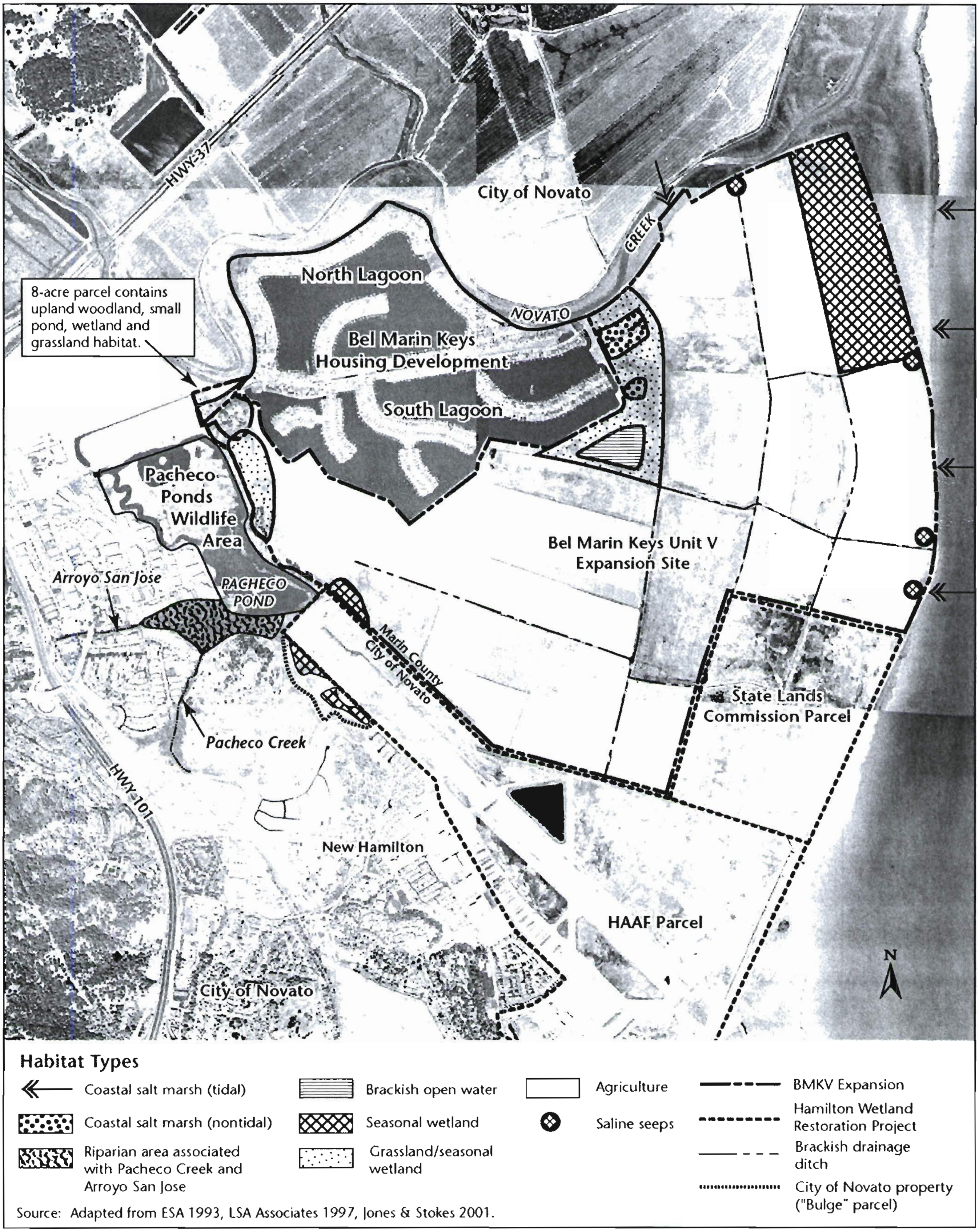

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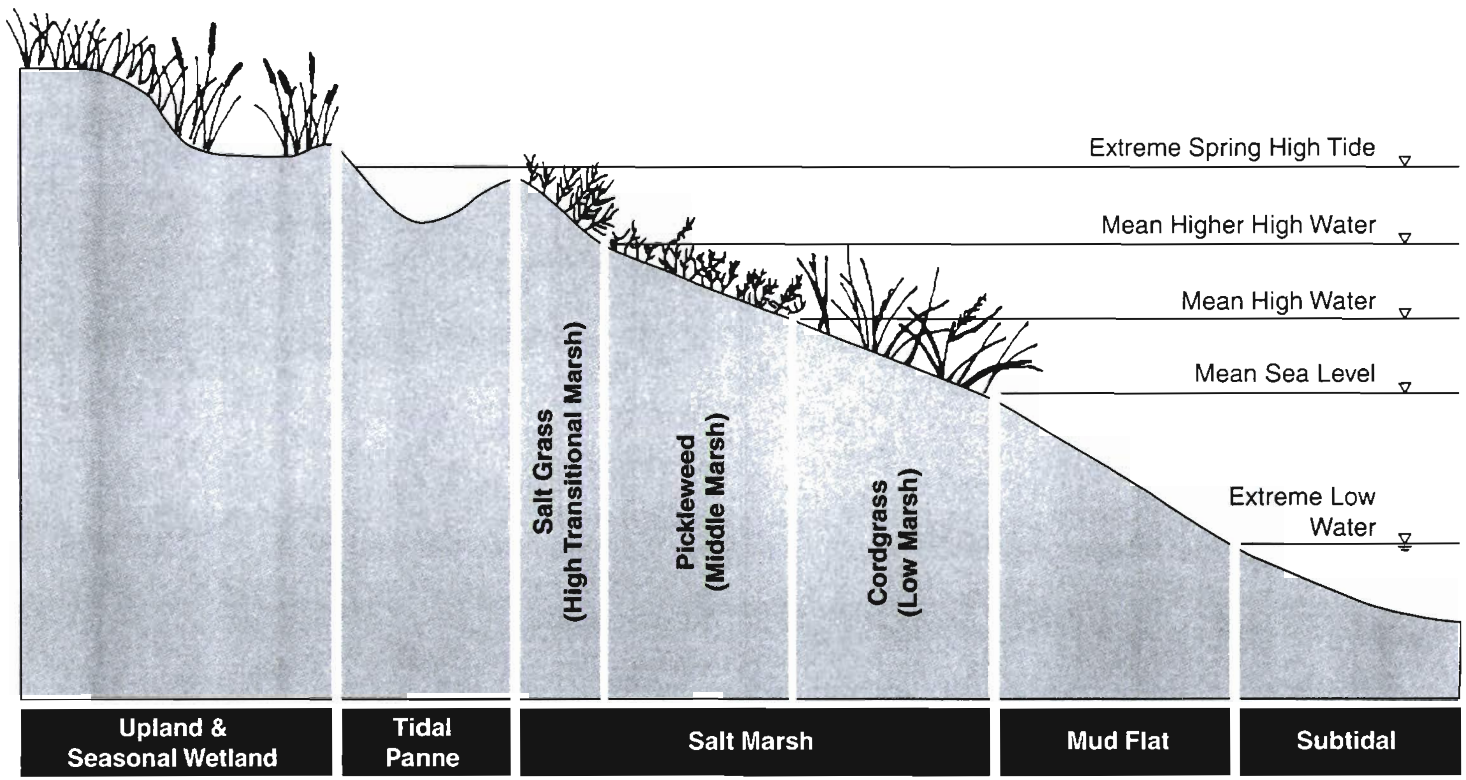
Figure 4-8
Habitat Types on the Bel Marin Keys Unit V Expansion Site



Source: Woodward-Clyde 1998.

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Figure 4-9
Schematic of Habitats by Tide Levels

Coastal salt marsh is located adjacent to the site along the Novato Creek channel and outboard of the San Pablo Bay perimeter levee. Coastal salt marsh contains persistent, rooted herbaceous vegetation dominated by cordgrass and pickleweed. The vegetation in the marsh habitat is used as direct cover and sources of food by rearing juvenile and adult fish, such as longfin smelt, chinook salmon, and steelhead. Emergent marsh habitat, however, is within the tidal zone and drains frequently; it is therefore not used for spawning. Benthic organisms use this habitat in the same way they use intertidal mudflats. Emergent marsh habitat also provides nesting, foraging, and escape cover for various songbirds and wading birds.

Brackish Open Water Habitat

Brackish open water habitat occurs on approximately 52 acres of the BMKV site and includes 1 of the borrow pits and the drainage ditches. Borrow Pit A is 10–15 feet deep, intersects the water table year-round, and is perennially inundated in all but drought years (LSA Associates 1997). Open water in the borrow pit ponds is used by water birds during migration and provides foraging areas for resident waterfowl (Environmental Science Associates 1993). The approximate size of Borrow Pit A is 15 acres.

Drainage ditch banks and channels also provide foraging habitat and cover for some species, such as herons, egrets, and dabbling ducks, as well as movement corridors for striped skunks, raccoons, and other species. The area of the drainage ditches is approximately 36 acres and includes small amounts of brackish marsh vegetation along the edges of the ditches.

Wetland Communities

The expansion area contains 4 types of non-agricultural wetland communities: coastal salt marsh (tidal), coastal salt marsh (nontidal), small amounts of brackish marsh in the drainage ditches, and seasonal wetland (see table 4-7). In addition, seasonal ponding occurs within the cultivated fields, though it varies in magnitude from year to year. Delineation of jurisdictional wetlands has been completed for the BMKV parcel (LSA Associates 1997) and has been verified by the Corps and the Natural Resources Conservation Service (NRCS). All of the non-agricultural wetland types, except brackish open water, are considered jurisdictional wetlands by the Corps in accordance with the federal Clean Water Act. Approximately 151 acres of cultivated fields have also been delineated as jurisdictional agricultural wetlands based on determination of a statistically derived average ponding area, in addition to vegetation and soils criteria (LSA Associates 1997).

Coastal Salt Marsh (Tidal)

Coastal salt marsh under tidal influence occurs in 2 locations in the expansion area: east of the perimeter levee at the eastern end of the expansion area between the levee and the open water of San Pablo Bay, and between the northern levee and Novato Creek. Approximately 20 acres of salt marsh habitat occur within the BMKV site, but more substantial areas are located outside the

site. This habitat can be divided into 3 distinct zones based on the frequency and duration of tidal inundation (figure 4-9). These zones are described below.

- Low marsh habitat occupies the elevations between mean tide level and mean high water and, as such, is inundated daily. In the expansion area, low marsh is adjacent to the open waters of San Pablo Bay and Novato Creek and is dominated by California cordgrass.
- Middle marsh habitat occupies the elevations between mean high water and mean higher high water. It is predominant outboard of the perimeter levee and is inundated frequently throughout each month, although for shorter periods than low marsh. Middle marsh is dominated by common pickleweed.
- High transitional-marsh habitat occupies the elevations between mean higher high water and the highest tide level. This habitat is inundated infrequently and for short periods. A narrow strip along the bayside of the levee supports high marsh and plant species that are tolerant of saline conditions but not adapted to frequent, long-term inundation, including saltgrass, alkali heath, fat-hen saltplant, and gumplant.

The tidal coastal salt marsh community provides food, cover, and breeding habitat for many wetland-dependent wildlife species. The dense vegetation and large invertebrate populations typically associated with salt marshes provide ideal foraging conditions for a variety of bird species, including rails, egrets, herons, waterfowl, and shorebirds. In addition to being important habitat for wetland-associated wildlife, the salt marsh community is an important component of the San Pablo Bay ecosystem, providing nutrients and organic matter to the mudflats and open water of the Bay. These, in turn, are important habitats for a variety of waterfowl, shorebirds, and other water birds. Wildlife species observed at the proposed wetland restoration site during field surveys conducted in 2001 and 2002 include double-crested cormorant, great blue heron, great egret, American coot, killdeer, northern harrier, salt marsh common yellowthroat and San Pablo song sparrow (May & Associates 2001; Jones & Stokes files 2002). Other species expected to use tidal coastal salt marsh include the raccoon, mallard, sora, Virginia rail, and willet.

Coastal Salt Marsh (Nontidal)

Small areas of coastal salt marsh vegetation that are not inundated by tides (approximately 21 acres total) are located along the interior slopes and base of levees along Novato Creek and San Pablo Bay and in 2 of the borrow pits. Dominant species include pickleweed, saltgrass, brass buttons, ryegrass, and coyote brush. These habitat areas may provide important refuge for wildlife associated with tidal salt marsh during periods of extreme high tides (Environmental Science Associates 1993).

Brackish Marsh

Small amounts of brackish marsh vegetation are present along the edge of the drainage ditches in the BMKV parcel. Dominant emergent wetland plants along

drainage ditches are alkali bulrush and cattail. Because marsh vegetation associated with ditches occurs in narrow linear bands, these habitat areas typically support a lower diversity of wildlife than larger, more contiguous units of brackish marsh. The area of the brackish marsh vegetation has not been estimated.

Seasonal Wetlands

Areas of seasonal wetland (approximately 114 acres total) are present in the field at the west end of the site, adjacent to the borrow pits, and in the field previously used for placement of dredged material (on the northeast side of BMKV). Plant species that may dominate in seasonal wetland habitat are saltgrass, alkali heath, salt marsh bulrush, fat-hen saltplant, western goldenrod, sheep sorrel, 6-weeks fescue, tall fescue, sedge, rush, and creeping wild rye (Environmental Science Associates 1993).

Seasonal wetlands potentially provide high-tide refugia for California clapper rail, California black rail, and other species that use tidal coastal salt marshes; seasonal foraging and resting habitat for migratory shorebirds, waterfowl, and other water birds; and foraging habitat for raptors, herons, egrets, blackbirds, raccoons, striped skunks, and aquatic garter snakes (Environmental Science Associates 1993).

Agricultural Wetlands

During winter, some of the agricultural fields become saturated or seasonally flooded with runoff from precipitation. Flooded fields provide foraging and resting habitat for a wide diversity of wintering and migrant shorebirds, waterfowl, and other water birds during winter. Based on a statistically derived average ponding area, approximately 151 acres of agricultural wetlands have been delineated on the BMKV site (LSA Associates 1997). Because ponding amounts can vary in location and size by year, these areas have not been mapped.

Grassland Community

Annual grassland vegetation in the expansion area (approximately 129 acres total) is ruderal (i.e., grows in disturbed areas) and is dominated by weedy, non-native annual grasses and forbs, such as ripgut brome, wild oats, Mediterranean barley, perennial ryegrass, yellow star-thistle, curly dock, bristly ox-tongue, and black mustard. Scattered shrubs and non-native trees, such as coyote brush, blackberry, and eucalyptus, are also present in some grassland areas (Environmental Science Associates 1993).

Annual grassland provides important habitat for various wildlife species. Representative wildlife species observed using grasslands at the expansion site are the turkey vulture, white-tailed kite, northern harrier, red-tailed hawk, golden eagle, American kestrel, short-eared owl, savannah sparrow, western meadowlark, and Brewer's blackbird (May & Associates 2001; Jones & Stokes files). The previous EIR/EIS also mentions the following species observed onsite or nearby that are likely to use the grassland areas and the agricultural areas: short-eared owl, Cooper's hawk, and sharp-shinned hawk. Other common

species that use or are likely to use the grassland include Canada geese, coyote, fox, skunk, deer, rabbits, raccoons, possums, ground squirrels, voles, mice, rats, gophers, moles, and snakes. Many of these species will also use the agricultural fields periodically throughout the year.

Trees

The BMKV site contains several groves of eucalyptus trees, including small groves on the eastern side along a drainage ditch and in the center of the site near the small house and equipment shed. Larger groves of eucalyptus are located along the western levee adjacent to Pacheco Pond, and on and immediately adjacent to Headquarters Hill. Headquarters Hill is on private land and is not part of the restoration project. A red-tailed hawk nest was documented in the eucalyptus grove in the prior EIS/EIR (Environmental Science Associates 1993). Other hawks may also use site trees for nesting. The groves are also reportedly used for roosting by a number of egrets, herons, raptors, and other bird species, some of which may also nest in the groves. There are several isolated oaks on the project site and a valley oak stand on Headquarters Hill (Environmental Science Associates 1993).

Agricultural Lands

Most of the proposed wetland restoration site (approximately 1,241 acres) is composed of agricultural fields that are planted and harvested annually. Approximately 75% of these lands are managed for oat hay production. Following the harvest, fields remain fallow until the following planting season. When fallow, the fields typically support non-native invasive plants, such as star thistle (Environmental Science Associates 1993). Cultivated fields, particularly when fallow, provide habitat values similar to grasslands and provide habitat for raptors, songbirds, and small mammals. As noted above, approximately 151 acres of the agricultural land have been delineated as agricultural wetlands.

Developed Areas

Human-made structures present within the expansion area include drainage pump stations, small out buildings, and utility infrastructures. Compared to vegetated habitats, these developed areas support a low diversity of wildlife. Species commonly associated with developed areas include the barn swallow, northern mockingbird, American crow, and European starling. Several owl species, including several barn owls and a great horned owl, were observed inside the barn on the western side of the site and in the equipment shed in the center of the site; other owls or raptors may also use the structures. Several commenters on the Draft SEIR/EIS mentioned possible use of the barns by bats. However, bats were not observed during reconnaissance of these structures nor documented in the prior EIR/EIS (Environmental Science Associates 1993).

Biological Communities–HAAF and SLC Sites

The habitats present at the HAAF and SLC sites were described in the 1998 EIS/EIR prepared for the HWRP, which is incorporated herein by reference.

Biological Communities–Land Currently Owned by the City of Novato West of HWRP (the "Bulge" parcel)

The habitat present on the land immediately west of the HWRP (known as the Bulge parcel) is discussed in this document because the Bay Trail would extend adjacent to this area under all 3 alternatives and the interpretive center and access area would be located in this area under Alternative 1 and Revised Alternative 2. This area consists of upland, seasonal wetland, concrete pads, and asphalt and dirt roads (see figure 4-8).

Upland areas are vegetated by upland and ruderal grasslands. The species include brome grasses, quaking grass, yellow star-thistle, panicled willow-herb, Italian thistle, bird's-foot trefoil, and English plantain. Grasslands in the area have been classified previously as ruderal grassland. These areas are underlain by soils composed of fill. (Jones & Stokes 2002a)

No trees are present in the area to be crossed by the Bay Trail or at the proposed interpretive center/access area location. The grassland is considered only moderate-quality wildlife habitat because the area is fragmented by the runway and service roads. Representative wildlife species observed using grasslands at the adjacent HAAF project site are the gopher snake, western fence lizard, turkey vulture, red-tailed hawk, northern harrier, American kestrel, California quail, ring-necked pheasant, savannah sparrow, western meadowlark, Brewer's blackbird, California vole, black-tailed hare, desert cottontail, black-tailed deer, coyote, striped skunk, and raccoon.

There are seasonal wetlands located in low-lying areas on the northern and southern side of this area (see figure 4-8). These seasonal wetlands are vegetated by annual grass and forb hydrophytes. The dominant species include Italian ryegrass, salt grass, alkali heath, fathen, and curley dock (Jones & Stokes 2002a).

In the center of this area, there is a large remnant concrete pad. This pad is surrounded by annual grassland and dirt and gravel roads (see figure 4-8). This is the proposed location of the interpretive center; the adjacent areas would be used for the access area.

Biological Communities–Pacheco Pond and Lower Portion of Tributaries

The general profile of existing biological resources in Pacheco Pond and the confluence of Arroyo San Jose and Pacheco Creek is based on the Hamilton Public Access Bay Trail Plan (City of Novato and California State Coastal Conservancy 2001), contact with MCFCWCD biologists, a field reconnaissance, and aerial photography.

Pacheco Pond is heavily used both in winter and summer by a wide range of water birds, including, grebes, loons, cormorants, rails, American white pelicans,

coots, moorhens, terns, gulls, herons, egrets, shorebirds, blackbirds, and other waders and dabbling ducks. In winter, rafts of diving birds, including canvasback and scaup, rest and feed in the pond (Marin Audubon Society 2002). A number of species breed in the surrounding area due to the presence of a surrounding cattail marsh that provides food and cover. The pond itself also reportedly supports a number of fish species, including striped bass, smelt, and bullhead.

The confluence of Pacheco Creek and Arroyo San Jose creates a riparian area on the western side of Pacheco Pond that supports willows, non-native berries, and other freshwater riparian species. Saltmarsh Common Yellowthroat has previously been observed in the wetland/riparian area north and east of Ammo Hill (U.S. Army Corps of Engineers 1996a). Song sparrow and green herons have also been reported in the riparian area (Marin Audubon Society 2002). Northwestern pond turtle has been found in or near this area (Lewis 2002). A red-legged frog survey has been conducted in or near the confluence area, but no frogs were located (Lewis 2002).

The outflow from Pacheco Pond discharges into Novato Creek via a leveed channel, controlled by six flap gates. This structure apparently acts as a partial barrier to anadromous fish, in that access from Novato Creek to the Pacheco Pond outlet can only occur when flow from Pacheco Pond is sufficient to open the flap gates. This should occur in the wet season, following rains, at low-tide, but may not occur at all during summer. No self-sustaining runs of anadromous fish are known to exist in Pacheco Pond or its tributaries. However, there are anecdotal reports of salmon in Arroyo San Jose, and in December 2001, 3 adult chinook salmon were reported spawning in Arroyo San Jose Creek above Highway 101, upstream of Pacheco Pond (Lewis 2002). The reported individuals may have gained access to the area during maintenance of the Pacheco Pond outlet structure (Charldon 2002).

The presence of adult chinook salmon has been recorded in a number of rivers and creeks draining into San Francisco and San Pablo Bays, however it is not known whether any of these populations are self-sustaining (National Marine Fisheries Service 1999). It is believed that present day adults may have originated from numerous off-site releases of Central Valley hatchery fall-run chinook salmon into the delta or bay (National Marine Fisheries Service 1999). The chinook salmon reported in Arroyo San Jose were most likely fall-run chinook of hatchery origin. Other runs of chinook salmon which migrate through San Pablo Bay include winter and spring runs which typically spawn much higher in the river systems (450 to 900 and 45 to 1,600 meters elevation respectively) in upper mainstem reaches, higher streams, and the spring fed headwaters (Myers et al. 1998).

Based on aerial photography and site reconnaissance, all of the area adjacent to the confluence is wetland, as is the area between the northern end of the MCFCWCD access road and Bel Marin Keys Boulevard.

Special-Status Species

Special-status species are plants and animals that are legally protected under the state and federal Endangered Species Acts (ESAs) or other regulations, and other plants and animals that are considered sufficiently rare to qualify for consideration under NEPA and CEQA. The categories for special-status plants and animals are described below.

- Species listed or proposed for listing as threatened or endangered under the federal ESA (50 Code of Federal Regulations [CFR] 17.12 [listed plants], 50 CFR 17.11 [listed animals], and various notices in the Federal Register [FR] [proposed species])
- Species that are candidates for possible future listing as threatened or endangered under the federal ESA (61 CFR 7596-7613, February 28, 1996)
- Species listed or candidates for listing by the State of California as threatened or endangered under the state ESA (14 CCR 670.5)
- Species that meet the definitions of rare, threatened, or endangered under CEQA (State CEQA Guidelines, Section 15380)
- Plants listed as rare or endangered under the California Native Plant Protection Act (CNPS) (California Fish and Game Code, Section 1900 et seq.)
- Plants considered by CNPS to be rare, threatened, or endangered in California (Lists 1B and 2 in California Native Plant Society [2001])
- Plants listed by CNPS as those about which more information is needed to determine their status and plants of limited distribution (Lists 3 and 4 in California Native Plant Society [2001]) that may be included as special-status species on the basis of local significance or recent biological information
- Animal species of special concern to DFG (Remsen 1978; California Department of Fish and Game and Point Reyes Bird Observatory 2001 [birds], Williams 1986 [mammals], Jennings and Hayes 1994 [amphibians and reptiles], and Moyle et al. 1995 [fish])
- Animals fully protected in California (California Fish and Game Code, Section 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians])

Special-status plant and animal species that occur or have potential to occur in or near the expansion area and their likely status in the area are presented in table D-1 in appendix D.

Special-Status Plants

Fourteen special-status plant species have potential to occur in or near the expansion area (appendix D); however, they are not present in the BMKV parcel. No special-status plant species have previously been reported from the expansion area (California Natural Diversity Data Base 1997).

Potentially suitable habitat is present in the expansion area for only 3 of those species: soft bird's-beak, Point Reyes bird's-beak, and Marin knotweed (Environmental Science Associates 1993). This potential habitat is associated with the transitional zone at the upper margins of coastal salt marshes. These species were not found during rare plant surveys conducted in 1980, 1985, 1988, 1991, and 2001 (Environmental Science Associates 1993, May & Associates 2001). Therefore, this analysis assumes that no special-status plant species are present in the expansion area or will be affected by the proposed BMKV expansion.

Special-Status Animals

Nineteen special-status fish and wildlife species are known to occur or are assumed to use suitable habitat within diked portions of the expansion area or in marshes and aquatic habitats bayside of the perimeter levees or in areas immediately adjacent to the BMKV site (see appendix D). These species are listed below.

- Longfin smelt
- Steelhead (Central Valley and Central California Coast ESUs)
- Chinook salmon (Sacramento River Winter-run, Central Valley Spring-run , and Central Valley Fall-run ESUs)
- Coho salmon (Central California Coast ESU)
- Double-crested cormorant
- California brown pelican
- White-tailed kite
- Northern harrier
- Golden eagle
- Cooper's hawk
- Sharp-shinned hawk
- Peregrine falcon
- California clapper rail
- California black rail
- Short-eared owl
- Burrowing owl
- Saltmarsh common yellowthroat
- San Pablo song sparrow
- Salt marsh harvest mouse

Invasive Non-Native Plant Species

Several invasive non-native plant species are of concern in the San Francisco Bay region. These plants often out-compete native vegetation, decrease species diversity, and eliminate habitat features necessary for special-status wildlife species. Of particular concern are several species of cordgrass, perennial pepperweed, and stinkwort.

Smooth cordgrass spreads by fragmentation of the rhizomes and, less commonly, by seed. Common cordgrass and dense-flowered cordgrass spread by both methods. Salt-meadow cordgrass appears to spread primarily by seed. Smooth cordgrass excludes the native California cordgrass. Where it invades open mudflats, it may reduce available habitat for foraging shorebirds, fish, and invertebrates.

The ecological consequences of non-native cordgrass invasion are not well known, and the effectiveness of control techniques is not well documented. The Conservancy is developing a separate EIR/EIS to address effects of controls, and the joint state–federal CALFED program is funding studies on effects and control strategies.

Perennial pepperweed is a widespread invasive species found in brackish to alkaline/saline wetlands (Bossard et al. 2000). It forms dense stands that exclude native species, including soft bird's-beak and Suisun marsh aster, 2 special-status plants that occur locally in the vicinity of North Bay marshes. Perennial pepperweed spreads by seed and by pieces of the root system.

Stinkwort or stink aster, an invasive non-native species that colonizes disturbed upland habitats and seasonal drainages, has been reported along Coyote Creek, at the Alviso Marina, and at Baylands Park in Sunnyvale (Preston 1997). At the marina, it occurs at the upper edges of tidal marsh. This species has only recently been identified as spreading to new areas in California, and its potential for displacing native species and altering habitat is not yet established.

Other non-native plants common in northern saltmarsh and adjacent upland habitats in the San Francisco Bay region are Mediterranean saltwort, brass buttons, slender-leaved iceplant, Australian saltbush, ripgut brome, and rabbit's-foot grass (Baylands Ecosystem Habitat Goals 2000).

Environmental Consequences and Mitigation Measures

This section describes methods used to analyze potential impacts of the restoration alternatives compared to the No-Action Alternative, potential impacts and impact mechanisms of each restoration alternative, and recommended mitigation measures to reduce significant impacts to a less-than-significant level.

Approach and Methodology

Analytical Methods

On a landscape scale, direct impacts on existing aquatic, wetland, and grassland habitats were evaluated by comparing the quantity and quality of each type of habitat predicted to be present at the end of the 50-year evaluation period under each restoration alternative with habitat conditions under the No-Action Alternative. Fish and wildlife species that occur or have potential to occur in the expansion area were presumed to be indirectly affected by implementation of an alternative if the quantity or quality of habitats with which they are typically associated would be affected, taking into account the net changes in habitat associated with each alternative compared to the No-Action Alternative.

Direct impacts on individual species were assessed qualitatively based on the likely sensitivity or susceptibility of the species to disruption as a result of activities that may be associated with implementation of one of the restoration alternatives (e.g., noise associated with equipment operation during construction). Both short-term and long-term impacts are assessed.

It should be noted by the reader that the project impact baseline for all of the impacts discussed below consists of the existing habitats onsite and their overall value to the local and regional ecosystem. The impact assessment takes into account the amount and quality of the habitat available without the project and the amount and quality of the habitat available with the project when determining the significance of the impact and the necessity and adequacy of mitigation. The future proposed habitats are not part of the baseline for impact assessment. However, the quality of future habitats is an important consideration in project design, and measures are proposed to further project goals, such as "creating and maintaining wetland habitats that sustain viable wildlife populations.

A major assumption used in this analysis is that conditions predicted to result with implementation of the restoration alternatives would actually develop within 50 years of implementation of the proposed expansion. Predictions of future conditions are largely based on predicted rates of sediment accumulation, subsidence of dredged and other fill material, and colonization of plants, as well as predictions of the effects of wave action on plant colonization. The actual rate at which nontidal and tidal wetland habitats would evolve and their distribution on the expansion site is somewhat speculative, however, because of uncertainties regarding the actual function and interaction of these parameters in tidal systems.

Other assumptions used to conduct this analysis include the following.

- Restored habitats and supporting hydrology will have stabilized under each of the restoration alternatives within 50 years of implementation of the proposed expansion.

- All potential sources of surface and subsurface hazardous materials on the expansion site will be removed or isolated before the selected restoration alternative is implemented.
- All dredged material and other fill material from offsite sources used for construction will meet the criteria and standards established by the DMMO and other regulatory agencies with jurisdiction over the site.

Impact Mechanisms

The following types of activities associated with implementation of the restoration alternatives could result in loss of or disturbance to aquatic, wetland, and grassland habitats and associated species.

- Creating a staging area to provide storage of topsoil, heavy equipment, fuel and supplies
- Modifying existing power towers by jacketing them in asphalt and concrete, and driving heavy equipment to and from the towers
- Excavating the upper foot of topsoil and removing it to a staging area
- Operating equipment and other construction activity, including constructing internal and perimeter levees and trails, grading, and excavating channels and levee breaches
- Operating a hydraulic off-loader and placing the dredged material pipeline across a portion of San Pablo Bay and in tidal coastal salt marsh
- Placing dredged material for restoration of wetland and upland habitat areas (under Alternative 1 and Revised Alternative 2)
- Reintroducing tidal flow to currently nontidal lands
- Constructing a water-quality detention pond at the mouth of the excavated main channels
- Installing drainage and other water-control infrastructure (under Alternative 1 and Revised Alternative 2)
- Performing management and maintenance activities necessary to maintain target habitats (e.g., activities associated with control of noxious weeds), maintain operation and integrity of infrastructure (e.g., water drainage and control structures), and control mosquito populations
- Colonization of invasive non-native vegetation species that displace or prevent establishment of native vegetation potentially lowering the habitat value of restored wetlands
- Constructing, accessing, and using the Bay Trail
- Potentially increasing bioavailability of contaminants as a result of dredged material placement (See the *Water Quality* section above for a discussion of

the potential for increased availability of contaminants due to use of dredged material and due to the potential for increased mercury methylation. Because this impact is covered in the *Water Quality* section, it is not discussed in this section.)

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding biological resources, the proposed expansion was identified as resulting in a significant impact on the environment if it would result in

- long-term degradation of a sensitive plant community because of substantial alteration of land form or site conditions, including a decrease in the acreage of intertidal and subtidal aquatic habitats and a decrease in the acreage or quality of tidal or nontidal wetlands;
- substantial loss of a plant community and associated wildlife habitat, including a substantial decrease in the acreage or quality of waterfowl breeding or wintering habitat or a substantial decrease in the acreage or quality of migrant and wintering shorebird habitat;
- fragmentation or isolation of wildlife habitats;
- substantial disturbance of wildlife resulting from human activities;
- avoidance by wildlife of biologically important habitat for substantial periods, which may increase mortality or reduce reproductive success;
- disruption of natural wildlife movement corridors; or
- substantial reduction in local population size attributable to direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of:
  - species that are federally or state listed or proposed for listing as threatened or endangered;
  - portions of local populations that are candidates for federal or state listing and federal and state species of concern; or
  - species qualifying as rare and endangered under CEQA.

The following were also considered in determining whether an impact on a biological resource would be considered significant:

- federal or state legal protection of the resource;
- federal, state, and local agency regulations and policies regarding the resource;
- documented local or regional scarcity and sensitivity of the resource; and
- local and regional distribution and extent of the resource.

An alternative was considered to have a beneficial impact if it would result in a substantial increase in the quantity or quality of aquatic, wetland, and grassland communities or of habitat for wintering waterfowl, migrant and wintering shorebirds, or special-status species.

Impacts and Mitigation Measures of the No-Action Alternative

Under the No-Action Alternative, no wetland restoration would occur, and the expansion site would remain in its present condition. No change in the current quantity or quality of biological resources would be anticipated, and no mitigation measures would be required.

Impacts and Mitigation Measures Common to Alternatives 1–3

Figures 3-1, 3-5 and 3-8 (in chapter 3 of this document) illustrate the distribution, 50 years after implementation of the proposed expansion, of habitats restored under Alternative1, Revised Alternative 2, and Alternative 3. Table 4-7 presents a comparison of the estimated extent of habitat restored under each of the restoration alternatives and the expected net change in the extent of habitats relative to the No-Action Alternative (i.e., existing conditions).

Impact BIO-1: Increase in Subtidal Aquatic Habitat for Resident and Anadromous Fish

Subtidal aquatic habitat is expected to increase under the restoration alternatives. As sediment deposition occurs, the open-water habitat created initially by breaching the levees would decrease. Because dredged material would be placed to raise the existing elevation of the expansion area before breaching levees under Alternative 1 and Revised Alternative 2, the rate at which the extent of open water decreases under those alternative is expected to be much greater than under Alternative 3. Stable, vegetated channels would develop, and the habitat value of open water would increase as these channels become deeper and wider. These channels could be used as rearing habitat by longfin smelt and other estuarine and marine fish species. The channels could also provide habitat for phytoplankton, zooplankton, and benthic invertebrates, which provide important food sources for fish. Juvenile chinook salmon and steelhead may temporarily rear in the slough channels during their seaward migration. The increase in aquatic habitat would result in a beneficial impact on resident and anadromous fish.

Impact BIO-2: Short-Term Loss of or Disturbance to and Long-Term Increase in Intertidal Mudflats

A small area of intertidal mudflat could be lost or disturbed near the bayside termini of the excavated subtidal channels as a result of channel scour from tidal flow through the channel. The loss of intertidal mudflat habitat resulting from scour would be substantially offset, however, by the development of intertidal mudflat habitat along the channel margins following excavation and along the margins of levees following introduction of tidal flows to the restoration site. Intertidal mudflats would develop between mean sea level and extreme low water (figure 4-8). As sediments are deposited and the site develops, intertidal mudflats would be present in varying amounts. When the wetlands are fully functioning, intertidal mudflats would be limited to the slough channels and along the margins of subtidal channels. The short-term loss of intertidal mudflats is considered less than significant because only a small area would be disturbed, and this would be replaced under each of the restoration alternatives. Intertidal mudflats, however, are expected to develop more rapidly under Alternative 1 and Revised Alternative 2 than under Alternative 3 because placement of dredged materials will accelerate their development.

Impact BIO-3: Temporary Disturbance to the Northern Harrier, White-tailed Kite, Golden Eagle, Cooper's Hawk, Sharp-shinned Hawk, Short-eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow during Construction

Noise, vibration, visual, and proximity-related disturbances associated with construction could adversely affect the above-mentioned special-status species, if they are nesting on or adjacent to the BMKV site during construction. If individuals of these species nest in the expansion area during the construction period, construction disturbances could cause them to abandon their nests or young. The breeding success of these species could be reduced if disturbances reduce the ability of adults to properly care for their eggs or young (also see discussion of tree removal under Impact BIO-32). Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-1.

Mitigation Measure BIO-1: Conduct Surveys to Locate Northern Harrier, White-tailed Kite, Golden Eagle, Cooper's Hawk, Sharp-shinned Hawk, Short-eared Owl, Burrowing Owl, Saltmarsh Common Yellowthroat, and San Pablo Song Sparrow Nest Sites before Construction Is Initiated and Avoid Breeding Sites.

The Conservancy, Corps, or successors in interest will conduct surveys to locate nest sites of the above-mentioned species in suitable breeding habitats in the spring of each construction year. Surveys will be conducted by a qualified

biologist using survey methods approved by DFG. Survey results will be submitted to DFG before construction is initiated. If nests or young of these species are not located, construction may proceed. If nest sites or young are located, the Conservancy, Corps, or successors in interest will consult with DFG to determine what mitigation measures could be implemented to avoid or reduce potential disturbance-related impacts on these species (e.g., establishing buffers around active nest sites or sequencing construction activities to avoid activities near nesting habitats during the breeding season).

Impact BIO-4: Potential for Construction-Related Mortality of Salt Marsh Harvest Mice

Breaching and lowering the perimeter levee and excavating tidal channels in the outboard marsh could result in direct mortality of salt marsh harvest mice, a federally listed,state-listed and state fully protected species. This impact is considered significant. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-2.

Mitigation Measure BIO-2: Remove Salt Marsh Harvest Mouse Habitat and Place Barrier Fencing in the Immediate Vicinity of Operating Equipment.

The potential for construction-related mortality of salt marsh harvest mice could be reduced or eliminated by hand-removal of pickleweed habitat (pickleweed in tidal marshes is habitat for salt marsh harvest mice) and subsequent placement of a barrier fence 20 feet from the boundaries of construction areas in and adjacent to coastal salt marsh habitat. As the salt marsh harvest mouse is a fully protected and listed state species and a listed federal species, the Conservancy, Corps, or successors in interest will consult with USFWS and DFG to evaluate these and any other appropriate methods for avoiding construction-related mortality of salt marsh harvest mice.

Impact BIO-5: Potential for Construction-Related Mortality of California Clapper Rails and California Black Rails

Breaching and lowering the perimeter levee and excavating tidal channels could result in direct mortality of California clapper rails and California black rails. Nests with eggs or young birds could be crushed by construction equipment operating in the outboard tidal marsh. This impact is considered significant because expansion activities could result in the direct mortality of individuals of these 2 special-status species. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-3.

Mitigation Measure BIO-3: Avoid Operation of Equipment within 250 feet of the Outboard Tidal Coastal Marsh during the Breeding Period of the California Clapper Rail and California Black Rail.
The Conservancy, Corps, or successors in interest will avoid operating construction equipment in the outboard tidal marsh from February 1 to July 31. A 250-foot buffer has been previously recommended in the LTMS Biological Opinion and for activities that have occurred as a result of restoration activities under the HWRP. This buffer is also recommended for the BMKV expansion. If construction equipment must operate in the marsh during this period, surveys will be conducted by a qualified biologist using survey methods approved by USFWS and DFG before construction is initiated to locate clapper rail and black rails. If rails are located, the Conservancy, Corps, or successors in interest will consult with USFWS and DFG to determine what, if any, additional mitigation measures may be required to allow construction to proceed.

Impact BIO-6: Potential for Mortality of San Pablo Song Sparrows

Construction activities in tidal and nontidal marsh habitats and inundation of nontidal wetlands by tidal flow could result in direct mortality of San Pablo song sparrows. Nests with eggs or young birds could be crushed by construction equipment or inundated or toppled by tidal flow. This impact is considered significant because expansion activities could result in the mortality of individuals of this special-status species. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-4.

Mitigation Measure BIO-4: Conduct Surveys to Locate San Pablo Song Sparrow Nest Sites before Construction Is Initiated and Avoid Breeding Sites.
The Conservancy, Corps, or successors in interest will conduct surveys to locate San Pablo song sparrow breeding territories in suitable marsh habitats in the spring of each construction year. Surveys will be conducted by a qualified biologist using survey methods approved by DFG. Survey results will be submitted to DFG before construction is initiated. If active breeding territories are not located, construction may proceed. If breeding territories are located, the Conservancy, Corps, or successors in interest will consult with DFG to determine what mitigation measures could be implemented to avoid or reduce potential mortality of this species (e.g., establishing buffers around active nest sites or breeding territories, or sequencing construction activities to avoid potential impacts on the species during the breeding season).

Impact BIO-7: Potential for Mortality of Burrowing Owls

Operating equipment in grasslands west of the perimeter levee and introducing tidal flow could result in direct mortality of burrowing owls. Occupied nesting

burrows could be crushed or buried by construction equipment or inundated as a result of tidal flow. This impact is considered significant because it could result in the direct mortality of individuals of this special-status species. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-5.

Mitigation Measure BIO-5: Conduct Surveys to Locate Burrowing Owl Nest Sites before Construction Is Initiated and Avoid Breeding Sites.
The Conservancy, Corps, or successors in interest will conduct surveys to locate burrowing owl nest sites in suitable grassland habitats in the spring of each construction year. Surveys will be conducted by a qualified biologist using survey methods approved by DFG. Survey results will be submitted to DFG before construction is initiated. If active nests are not located, construction may proceed, but the Conservancy, Corps, or successors in interest will consult with DFG to determine what mitigation measures could be implemented to reduce potential mortality of this species (e.g., establishing buffers around active nest sites or sequencing construction activities to avoid potential impacts on the species during the breeding season).

Impact BIO-8: Potential for Construction-Related Mortality of Outmigrating Salmonid Smolts

Breaching and lowering the perimeter levee and excavating tidal channels could result in direct mortality of outmigrating salmonid smolts if individuals were present when construction occurred. This impact is considered significant because expansion activities could result in the direct mortality of individuals of special-status species. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-6.

Mitigation Measure BIO-6: Avoid Construction that Could Affect Tidal Aquatic Habitats when Salmonid Smolts Could Be Present.
The Conservancy, Corps, or successors in interest will, to the extent feasible without impeding successful construction completion, avoid construction activities that could affect tidal aquatic habitats (e.g., construction associated with lowering the perimeter levee and excavating tidal channels through the outboard salt marsh) during periods when outmigrating salmonid smolts could be present. If construction activities must occur during periods these species could be present, the Conservancy, Corps, or successors in interest will consult with , NMFS and DFG to determine what, if any, additional mitigation measures may be required to allow construction to proceed.

Impact BIO-9: Potential for Reduced Access to Freshwater Habitat for Anadromous Salmonids

Installation of culvert structures into the Pacheco Pond levee to redirect some or all of the existing outlet flows into the restoration site could result in reduced anadromous fish access to freshwater habitats of the tributaries to Pacheco Pond (Arroyo San Jose and Pacheco Creeks). Currently, anadromous fish access to Pacheco Pond and its tributaries is limited by the existing pond outlet structures. Depending on the final culvert structure design chosen and decisions embodied in the amended water management plan for Pacheco Pond concerning outlet flow, anadromous fish access to Pacheco Pond and its tributaries could be reduced or eliminated.

There do not appear to be any self-sustaining runs of anadromous salmonids in Pacheco Pond and its tributaries (National Marine Fisheries Service 1998). The recently reported sighting (December 2001) of 3 adult chinook salmon in Arroyo San Jose Creek are most likely fall-run strays of hatchery origin based on the watershed in question (San Pablo Bay tributary), timing of occurrence (December), and known distributions (habitat elevation below 450 meters). Fall-run chinook salmon are a candidate species, and the latest status review did not indicate that the run warrants listing. Because these do not appear to be self-sustaining runs and do not appear to include listed species, this impact is considered less-than-significant. However, since one of the purposes of Pacheco Pond management is wildlife habitat conservation, potential fish passage should be considered when developing the amended water management plan for Pacheco Pond.

Impact BIO-10: Potential Disturbance to or Mortality of Special-Status Species Resulting from Monitoring and Adaptive Management Activities

Monitoring and adaptive management activities, such as mosquito abatement, water-control structure and levee maintenance, and control of noxious weeds, could be required to ensure restoration success. These activities could result in disturbance to or mortality of special-status species if special-status species occupy restored habitats. This impact is considered significant. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-7.

Mitigation Measure BIO-7: Develop and Implement a Restoration Monitoring and Adaptive Management Program Designed to Minimize Potential Impacts on Special-Status Species.

The Conservancy, Corps, or successors in interest will develop a restoration monitoring and adaptive management program, in coordination with USFWS, NMFS and DFG, within 1 year after the completion of construction. Important elements of the program will be scheduling intrusive activities to avoid periods

when special-status species are sensitive to disturbance and implementing management practices that have minimal effects on special-status species, to the greatest extent feasible.

Impact BIO-11: Loss of Refugia for the California Clapper Rail, California Black Rail, and Salt Marsh Harvest Mouse

Lowering portions of the perimeter levee to elevations approximating that of mean higher high water would result in the loss of suitable refugia for the California clapper rail, California black rail, and salt marsh harvest mouse when the outboard marsh is inundated during high tides. With implementation of the project, refugia would be provided by transitional and upland habitat areas restored at the upper elevations of restored tidal marshes. These habitat areas would be accessible to rails but could be too distant from the existing outboard marsh to be used by salt marsh harvest mice. Some portions of the lowered outboard perimeter levee, however, would be left at higher elevations that would not be inundated by tides and, would therefore continue to provide flood refugia for mice and rails. Therefore, this impact is considered less than significant and no mitigation is required.

Impact BIO-12: Increase in Suitable Habitat for the Brown Pelican and Double-crested Cormorant

Breaching the perimeter levee and introducing tidal flow to the expansion site east of the cross panhandle levee would initially create a large body of open water, which would provide suitable resting habitat for the brown pelican and double-crested cormorant. If tidal flows into the marsh were sufficient to entrain substantial numbers of fish and other prey items, open water areas would also provide suitable foraging habitat for these species. The area of suitable habitat for these species would decrease, however, as the expansion site aggrades with sedimentation and vegetation becomes established. Because placement of dredged material under Alternative 1 and Revised Alternative 2 is expected to increase the rate at which tidal coastal salt marsh develops, suitable habitat area for these species would decrease more rapidly under these alternatives than under Alternative 3. At maturity, subtidal channels would continue to provide suitable habitat for these species. Additionally, expansion of Pacheco Pond as proposed under the restoration alternatives would provide an increase in foraging and resting areas that may be utilized by these species. This impact overall is considered beneficial.

Impact BIO-13: Increase in Suitable Nesting Habitat for Resident Waterfowl

Development of undisturbed grassland, seasonal wetland, and tidal coastal marsh vegetation, all of which are expected to increase under each of the restoration alternatives (see table 4-7), would substantially increase the area of suitable waterfowl nesting habitat. This impact is considered beneficial.

Impact BIO-14: Loss of Coastal Salt Marsh

Excavation of subtidal channels through the tidal marsh would result in the direct loss of a small amount of high-, middle-, and low-tidal coastal salt marsh during excavation of levee breaches (estimated at 1 to 3 acres each). Increased scour of the lower Novato Creek channel due to an increase in tidal flows in the creek in Alternatives 1 and 2 only, would also result in loss of an estimated 2 to 5 acres of coastal salt marsh. Due to placement of dredge material and/or natural sedimentation approximately 21 acres of nontidal coastal salt marsh would be converted to tidal coastal salt marsh.

As a result of implementation of the proposed BMKV expansion, tidal marsh vegetation is expected to gradually colonize the newly established mudflats between the elevations of extreme spring high tide and mean sea level. Sites at these elevations could be colonized by tidal marsh vegetation following introduction of tidal flows, including portions of the lowered bayward levee, margins of the internal peninsulas, and perimeter levees. In the early years of the expansion, vegetation would most likely establish in locations sheltered from waves. The acreage suitable for establishing tidal coastal salt marsh (the zone between extreme high tide and mean sea level) is expected to increase as a result of sediment deposition. In addition, as the site aggrades and the extent of vegetated area increases, the effects of wave action on the ability of vegetation to establish would be reduced because established vegetation would attenuate wave energy across the site.

The loss of tidal and nontidal coastal salt marsh habitat is expected to be offset by tidal coastal salt marsh habitat that would develop on the site at a greater than 2:1 in-kind replacement ratio within 10 years following implementation of the proposed expansion. At maturity, an estimated 1,039, 899 and 1,274 acres of tidal coastal salt marsh would be restored under Alternative 1, Revised Alternative 2, and Alternative 3, respectively (see table 4-7). Establishment of tidal coastal salt marsh habitat would take longer under Alternative 3 than under the other alternatives due to the time it takes natural sedimentation to result in marsh plain elevations. If coastal salt marsh habitat developed as designed, the net increase in this habitat type would be a beneficial impact. Because of uncertainties regarding the rate of sedimentation and the associated rate of establishment of native salt marsh vegetation, however, there could be a time lag between the physical construction of the restoration site and establishment of new salt marsh habitat. Therefore, this temporal reduction in the amount of salt

marsh habitat is considered a significant impact. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-8.

Mitigation Measure BIO-8: Monitor Site Development and Implement Actions to Increase the Rate of Marsh Development, If Required. The Corps, in conjunction with the Conservancy or its successors in interest, will develop and implement a monitoring and adaptive management program to measure the rate of tidal coastal salt marsh establishment and the quantity and quality of established coastal salt marsh. Restored coastal salt marsh will be monitored annually for the first 5 years, and again in years 10 and 15 following breaching of the outboard levees. The Corps and Conservancy (or its successor) would be responsible for the first 5 years of monitoring and the monitoring in year 10. The Conservancy (or its successor) would be responsible for monitoring in year 15, because it is beyond the 13-year Corps monitoring period. The monitoring program will be designed to determine whether coastal tidal marsh is developing and whether its primary supporting physical processes (i.e., tidal exchange and sedimentation) are occurring at the estimated rate during the first 15 years following completion of construction. Subsequent inspection and surveillance of tidal salt marsh development at year 15 and beyond will be the responsibility of the non-Federal Sponsor in connection with its obligation for operating, maintaining, repairing, rehabilitating, and replacing the project. Because it will occur beyond the 13-year Project monitoring period, the Conservancy will independently assume (including on behalf of any successors) the responsibility for monitoring in year 15, in addition to its obligation to conduct inspection and surveillance of the project.

Major elements of the monitoring program will include the following.

- Measure the extent of tidal coastal salt marsh removed to to determine the amount of tidal coastal salt marsh that would need to be restored to compensate for loss of tidal coastal salt marsh at an in-kind replacement ratio of 2 acres restored for every acre of tidal salt marsh removed.
- Monitor parameters, including tidal stage, tidal current, wind speed and direction, wave characteristics, suspended sediment concentrations, sedimentation rates and distribution, marsh elevations, mudflat elevations, areal extent and locations of established or colonizing salt marsh vegetation, composition and density of established and colonizing plant species, characteristics of subtidal channel and marsh surface sediments, and San Pablo Bay shoreline characteristics.
- Monitor locations, including the tidal wetland interior, tidal wetland perimeter, subtidal channels, and existing San Pablo Bay marsh shoreline.
- Compare predicted and measured site development and function.
- Analyze monitoring data to identify possible reasons for differences between observed and predicted conditions.

- Recommend remedial actions that could be implemented if the restoration is not proceeding as designed.

Monitoring reports will be submitted by the Conservancy, Corps, or successors in interest to the DFG, USFWS, NMFS, and BCDC for each year in which monitoring of the development of coastal tidal salt marsh is conducted.

At the end of the initial 5-year monitoring period, if the development rate of the coastal salt marsh and the habitat quality of establishing coastal salt marsh do not appear to conform to the goals and projections established for the project or sufficient to replace each acre of removed tidal coastal salt marsh with 2 acres of contiguous, in-kind habitat within 10 years of levee breach, the Corps, in conjunction with the Conservancy, or its successors in interest will review the proposed BMKV expansion with representatives of DFG, USFWS, and NMFS to determine whether additional monitoring, adaptive management actions, or modifications are necessary to ensure that the functions and values of the affected coastal salt marsh habitat will be replaced. The Corps, in conjunction with the Conservancy or its successors in interest, may initiate a similar review of marsh development following completion of monitoring in year 10 if the Corps or Conservancy concludes that additional actions or modifications are necessary to meet restoration goals. The Conservancy or its successors in interest may initiate a similar review of marsh development following completion of monitoring in year 15 if they conclude that additional actions or modifications are necessary to meet restoration goals.

Monitoring of morphologic evolution will allow the Corps, in conjunction with the Conservancy or its successors in interest, to assess the success of habitat development and make decisions regarding corrective measures if necessary. Potential corrective measures include changing the breach and subtidal channel dimensions, altering perimeter levee berm morphology, and modifying channel characteristics within the restored tidal wetlands to ensure adequate morphologic evolution.

Impact BIO-15: Loss of Brackish Open Water Habitat and Brackish Marsh

Establishing tidal exchange at the expansion site would result in the direct loss of brackish open water habitat associated with Borrow Pit A and the drainage ditches, as well as the loss of brackish marsh vegetation on the edge of the drainage ditches. With diversion of some or all of the existing Pacheco Pond outlet flow to the restoration site, there is also a potential for siltation of the pond outlet channel between Bel Marin Keys Boulevard and Novato Creek, which could result in loss of brackish open water and emergent habitat that may be present along the edge of the channel. However, with the dual operation that is expected to be an outcome of the new water management plan, siltation may be averted. The loss of brackish open water habitat would be offset by the creation of a 40-acre expanded Pacheco Pond and 10 acres of emergent marsh around the

expanded pond under Alternatives 1 and 3 and by a 21-acre expanded pond, 12 acres of emergent marsh, and 277 acres of seasonal wetlands under Revised Alternative 2.

Because of uncertainties regarding the development of subsurface and surface hydrology and the associated quantity of brackish open water and emergent marsh vegetation (all alternatives) or seasonal wetlands (Revised Alternative 2) habitats of sufficient quality and quantity may not establish rapidly enough to offset impacts that occur during construction and inundation of the restoration site. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-9.

Mitigation Measure BIO-9: Monitor Development of Brackish Open Water, Emergent Marsh, and/or Seasonal Wetlands.
The Corps, in conjunction with the Conservancy, or its successors in interest, will develop and implement a 5-year monitoring program to measure the establishment rate, quantity, and quality of brackish open water, emergent marsh, and/or seasonal wetlands.

Major elements of the monitoring program will include the following.

- Measure areal extent and locations of established or colonizing marsh vegetation.
- Measure composition and density of established and colonizing plant species.
- Compare predicted and measured site development and function.
- Analyze monitoring data to identify possible reasons for differences between observed and predicted conditions.
- Recommend remedial actions that can be implemented if the restoration is not proceeding as designed.

Monitoring reports will be submitted by the Corps, Conservancy, or its successors in interest, to DFG, USFWS, NMFS, and BCDC for each year in which monitoring of the development of seasonal wetland and emergent marsh areas is conducted. If the rate, quality, and quantity of created habitat are not meeting restoration goals at the end of the 5-year period, the sponsoring agencies will consult with DFG, USFWS, NMFS, and technical experts regarding further monitoring and potential corrective actions.

Impact BIO-16: Loss of Seasonal Wetlands

Creating tidal exchange at the expansion site and constructing the internal levees would result in the loss of seasonal wetland habitat, totaling approximately 114 acres (see table 4-7). These areas occur as inclusions within highly disturbed non-native annual grassland. Because of their size, location, and level of disturbance, the wetlands provide few of the functions and values of higher

quality seasonal wetlands. Under Alternative 1, approximately 40 acres of seasonal wetland would be restored in the swale area. Under Revised Alternative 2, approximately 277 acres of seasonal wetland would be restored in the swale south of the BMK south lagoon and adjacent to Pacheco Pond. Under Alternative 3, approximately 10 acres of seasonal wetland would be restored. The loss of seasonal wetlands is considered less than significant because of the relative value of the wetlands and because the loss would be offset by the establishment of in-kind seasonal wetlands elsewhere on the expansion site that are expected to be of substantially higher habitat quality than the present seasonal wetlands as well as substantially greater acreage of out-of-kind tidal wetlands.

Impact BIO-17: Loss of Agricultural Wetlands

Creating tidal exchange at the expansion site and constructing the internal levees would result in the loss of agricultural ponding habitat totaling approximately 151 acres, based on the ponding analysis conducted as part of the wetland delineation (see table 4-7). Because of their size, location, and level of disturbance, the wetlands provide few of the functions and values of higher quality seasonal or other wetlands. Under Alternative 1, approximately 40 acres of seasonal wetlands, 40 acres of open-water habitat, 10 acres of emergent marsh around the expanded Pacheco Pond, and substantial amounts of tidal wetlands would be restored (see table 4-7). Under Revised Alternative 2, approximately 277 acres of seasonal wetland, 21 acres of open-water habitat, 12 acres of emergent marsh, and substantial amounts of tidal wetlands would be restored. Under Alternative 3, approximately 10 acres of seasonal wetlands, 40 acres of open-water habitat, 10 acres of emergent marsh around the expanded Pacheco Pond, and substantial amounts of tidal wetlands would be restored. The loss of agricultural wetlands is considered less than significant because of the relative value of the wetlands and because the loss would be offset by the establishment of both in-kind and out-of-kind replacement wetlands expected to be of higher quality.

Impact BIO-18: Loss of Grassland at BMKV Site

Constructing expansion levees, breaching levees, restoring wetlands, and inundation and other features of the restoration would result in the direct loss of approximately 129 acres of grassland habitat. Loss of grasslands would reduce the available habitat area for raptors, western meadowlarks, Brewer's blackbirds, and other regionally abundant songbirds.

The loss of grassland habitat would be offset by the creation of an estimated 300, 247, and 45 acres of higher quality grasslands near restored seasonal wetlands under Alternative 1, Revised Alternative 2, and 3, respectively (see table 4-7). These grassland areas would provide nesting cover for waterfowl and other ground-nesting species, and refugia for small mammals, reptiles, and other wildlife. Restored grassland would be seeded with desirable grasses and forbs

that would generally provide higher forage and cover values for wildlife than the grassland affected by the proposed BMKV expansion. The short-term impact associated with the loss of grassland is considered less than significant because grassland is regionally abundant, and the short-term loss of grassland habitat is expected to have little or no effect on regional populations of grassland-associated wildlife.

Impact BIO-19: Loss of Habitat for California Clapper Rail, California Black Rail, Salt Marsh Harvest Mouse, and Salt Marsh Common Yellowthroat

The California clapper rail, California black rail, salt marsh harvest mouse, and salt marsh common yellowthroat are dependent on salt marsh habitats. As described in Impact BIO-14, tidal coastal salt marsh would be lost as a result of construction of the proposed expansion restoration features in the tidal marsh. If restoration performs as predicted, suitable habitat for these species could be increased by approximately 1,021 acres under Alternative 1, approximately 882 acres under Revised Alternative 2, and approximately 1,256 acres under Alternative 3. Establishment of tidal marsh would take longer under Alternative 3 than under the other alternatives. However, because of uncertainties regarding the development of new marshes, this analysis must assume that the quality, type, and minimum habitat patch size required by these species may not develop (as described under Impact BIO-14). Therefore, this impact is considered significant. To reduce this impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measure BIO-8.

Impact BIO-20: Temporary Loss of Nesting Habitat for San Pablo Song Sparrow

Coastal salt marsh and brackish marsh support suitable nesting habitat for the San Pablo song sparrow. Limited amounts of tidal coastal salt marsh would be lost due to levee breaching and Novato Creek channel scour as discussed above under impact BIO-14. Implementation of wetland restoration could also result in removal of up to approximately 21 acres of nontidal coastal salt marsh and limited amounts of brackish marsh vegetation in the drainage ditches. If restoration performs as predicted, the extent of suitable species habitat could be increased by approximately 900 to more than 1,000 acres under the restoration alternatives (see table 4-7). Establishment of tidal coastal salt marsh habitat would take longer under Alternative 3 than under the other alternatives. However, because of uncertainties regarding development of the new marshes, this analysis assumes that the quality, type, and minimum habitat patch size required by this species may not develop (as described under Impacts BIO-14 and BIO-15). Therefore, this impact is considered significant. To reduce this

impact to a less-than-significant level, the Conservancy, Corps, or successors in interest would implement Mitigation Measures BIO-8 and BIO-9.

Impact BIO-21: Temporary Loss of Nesting and/or Foraging Habitat for Northern Harrier, White-tailed Kite, and Short-eared Owl

Construction activities associated with levee and seasonal wetland construction and inundation of approximately 129 acres of grassland habitat and 1,241 acres of agricultural lands by tidal flow would result in the permanent loss of suitable northern harrier, white-tailed kite, and short-eared owl nesting and/or foraging habitat. The loss of nesting and/or foraging habitat would be offset by the creation of 300 acres of upland and approximately 1,039 acres of tidal coastal salt marsh habitat under Alternative 1, approximately 247 acres of grassland and 899 acres of tidal coastal marsh habitat under Revised Alternative 2, and approximately 45 acres of grassland and 1,274 acres of tidal coastal salt marsh under Alternative 3 (table 4-7). This impact is considered less-than-significant, and mitigation is not required.

Impact BIO-22: Loss of Foraging Habitat for Golden Eagle and Burrowing Owl

Construction activities associated with levee and seasonal wetland construction and inundation by tidal flow of approximately 129 acres of grassland habitat and 1,241 acres of agricultural lands would result in the permanent loss of suitable golden eagle and burrowing owl foraging habitat. This loss of foraging habitat would be partially offset by restoration of 300, 247, and 45 acres of upland habitat under Alternative 1, Revised Alternative 2, and Alternative 3, respectively (table 4-7). This impact is considered less than significant because the loss of golden eagle and burrowing owl foraging habitat represents a small fraction of the available foraging habitat for these species in the region.

Impact BIO-23: Temporary Loss of Foraging Habitat for Wintering Waterfowl

Approximately 1,241 acres of agricultural land that provides foraging habitat for wintering waterfowl would be lost as a result of implementing Alternative 1, Revised Alternative 2, or Alternative 3 (see table 4-7). Lost agricultural foraging habitat, however, would be replaced by restored grassland, seasonal wetland, brackish marsh, and coastal tidal marsh habitats under each of the alternative. These restored habitats are expected to support suitable foraging and resting habitat for migrating and wintering waterfowl. Because most of the expansion area would not be accessible for recreation or other public uses, the expansion area could serve as an important resting area during the waterfowl hunting

season. The quality and quantity of suitable foraging and resting habitat would change over time (e.g., the area of open water and mudflat would be reduced as areas of restored tidal marsh aggrade and become vegetated). This impact is considered less than significant.

Impact BIO-24: Increase in Suitable Habitat for Migratory Shorebirds

Mudflats and shallow water (less than 6 inches deep) are important foraging and resting habitat areas for shorebirds that migrate through and winter in coastal and central California. Breaching the outboard levee and introducing tidal flow to the expansion area under the restoration alternatives would initially create areas of tidal mudflat around the edges of and along channels in the tidal marsh restoration area. Under Alternative 3, the extent of tidal mudflat over the 5-year evaluation period would be greater than under the other alternatives because tidal coastal salt marsh vegetation would require longer to establish. Tidal mudflats are expected to support large numbers of benthic organisms that are prey for shorebirds. As the site experienced aggradation but before large portions of the tidal marsh became vegetated, the area of tidal mudflat would increase; as the site continued to mature, tidal mudflats would primarily be limited to slough channels and along the margins of subtidal channels. This impact is considered beneficial.

Impact BIO-25: Potential for Spread of Invasive Non-Native Plants within and outside of Restoration Area during Construction Activities

Construction activities, including onsite grading in preparation for placement of dredged material, and use of dredged material from areas of the Bay could result in the spread of non-native invasive plant species that are problematic in the San Francisco Bay region. Of particular concern are several species of cordgrass, perennial pepperweed, and stinkwort.

Grading and use of dredged material could result in the spread of non-native cordgrasses, including smooth or salt-water cordgrass, common cordgrass, a fertile hybrid between smooth cordgrass and a British cordgrass, dense-flowered cordgrass, and salt-meadow cordgrass.

Smooth cordgrass is of highest concern because of its prevalence and its ability to alter native northern saltmarsh habitat, colonize tidal mudflats, and reduce the open water and capacity of channels (Bossard et al. 2000, Cohen and Carlton 1998, Callaway and Josselyn 1992).

Perennial pepperweed has been observed along Novato Creek near the BMKV site. Presence of this species may inhibit the establishment of native vegetation in floodplain areas adjacent to tidal channels. Tires and equipment could spread

this species to uninfested areas in the course of construction and grading activities.

Stinkwort is currently known from the South Bay and is likely to be restricted to levee banks and upland areas, and is consequently not expected to affect tidal habitats. It has the potential, however, to be a serious pest species and should be monitored.

Mediterranean saltwort, brass buttons, slender-leaved iceplant, Australian saltbush, ripgut brome, rabbit's-foot grass, and other invasive non-native plants have the potential to prevent establishment of native plants in and near areas where restoration activities are undertaken.

The potential for the spread of invasive non-native plants during construction could reduce the quality and function of the resulting marsh habitats. Furthermore, establishment of one or more of these species could create source populations that could subsequently invade other areas and potentially reduce the success of other tidal marsh restoration efforts. Implementation of the two mitigation measures described below could substantially mitigate this effect.

Mitigation Measure 10a: Prevent Spread of Perennial Pepperweed and Other Invasive Weeds to Uninfested Areas.

A qualified botanist will conduct a non-native plant assessment of areas subject to construction activities and will recommend specific measures to control spread of non-native species. Measures may include the establishment of wash stations for construction vehicles and equipment to clean tires of weed seeds and other propagules before they are moved offsite, and the development of an herbicide spray program to destroy perennial pepperweed or other invasive weed infestations prior to construction.

Mitigation Measure 10b: Monitor Restoration Sites for and Control Infestation by Invasive Non-Native Plants.

After being planted, restoration areas will be monitored for infestation of non-native cordgrasses, perennial pepperweed, stinkwort, and other potentially invasive species. All infestations occurring within wetland habitats will be controlled and removed to the extent feasible without jeopardizing the establishment of surrounding native vegetation. A long-term monitoring plan will be developed, subject to review and approval by USFWS and DFG, that will remain in effect until marsh habitat is established.

Impact BIO-26: Biological Benefit from Increases in Organic Carbon and Nitrogen Concentrations

As stated in the San Francisco Bay Area Wetlands Ecosystem Goals Project (1999) study, the biological productivity of the Bay has been diminished due to the lack of salt marsh habitats. Biological productivity or potential biological productivity can be measured by the organic carbon and nitrogen concentrations

present in a marsh system. Under the proposed BMKV expansion, restoring or creating salt marsh habitat (i.e., sub-tidal and tidal habitat) provides the increased area where mineral nutrients such as nitrate and orthophosphate and atmospheric carbon are converted to organic forms through the nitrogen and carbon cycle. Organic carbon and nitrogen are the primary building blocks for lower trophic-level organisms, which provide food for higher-level organisms. This potential for an increase in productivity is considered a biological benefit.

Impact BIO-27: Disruption of Sensitive Wildlife due to Bay Trail Construction, All Alternatives

All of the alternatives include extending the Bay Trail along the southwest perimeter of the HWRP and northward from the City of Novato levee to Pacheco Pond. The impacts of Bay Trail construction along the trail areas common to all alternatives are discussed in this section. Impacts unique to each alternative are discussed separately below.

The 2 areas common to all alternatives are (1) the southwestern perimeter of the HWRP, where the trail would be extended from the Hamilton residential area along existing roads and levees to a point approximately 700 feet from the outboard levee; and (2) the area west of the HWRP and north of the City of Novato levee trail, where the Bay Trail would be routed on the new levee to be built along the northwestern edge of the HWRP to Pacheco Pond. Figure 4-10 shows the Bay Trail segments that are common to all alternatives. The EIS/EIR for the authorized HWRP analyzed the effects of construction of levees and wetland restoration adjacent to these areas, but did not include a Bay Trail at the areas proposed in this document.

Levees would be built as part of the HWRP along the existing southern perimeter of the HAAF parcel and northward from the City of Novato levee to Pacheco Pond. No levee is proposed in the area between the southern perimeter levee and the pump station near the baseball field and residential area.

The southward extension of the Bay Trail would be on the existing paved and concrete areas south of the pump station until the perimeter levee is reached. The perimeter levee would be improved as part of the HWRP because it would be adjacent to the HWRP tidal wetland area. Construction of the levee was analyzed in the prior EIS/EIR and is not reanalyzed here. Construction of the Bay Trail on the levee as part of completion of the levee is not expected to result in any additional impact on sensitive wildlife.

The northward extension of the Bay Trail would be along the levee to be constructed from the City of Novato levee to Pacheco Pond. Because the trail would be constructed along the new levee, there would be little to no impact to sensitive wildlife or habitat outside of that already analyzed in the 1998 EIR/EIS. Because there are grasslands just west of the proposed levee and trail location, the indirect impact to the grasslands would be similar to Impact BIO-3 described

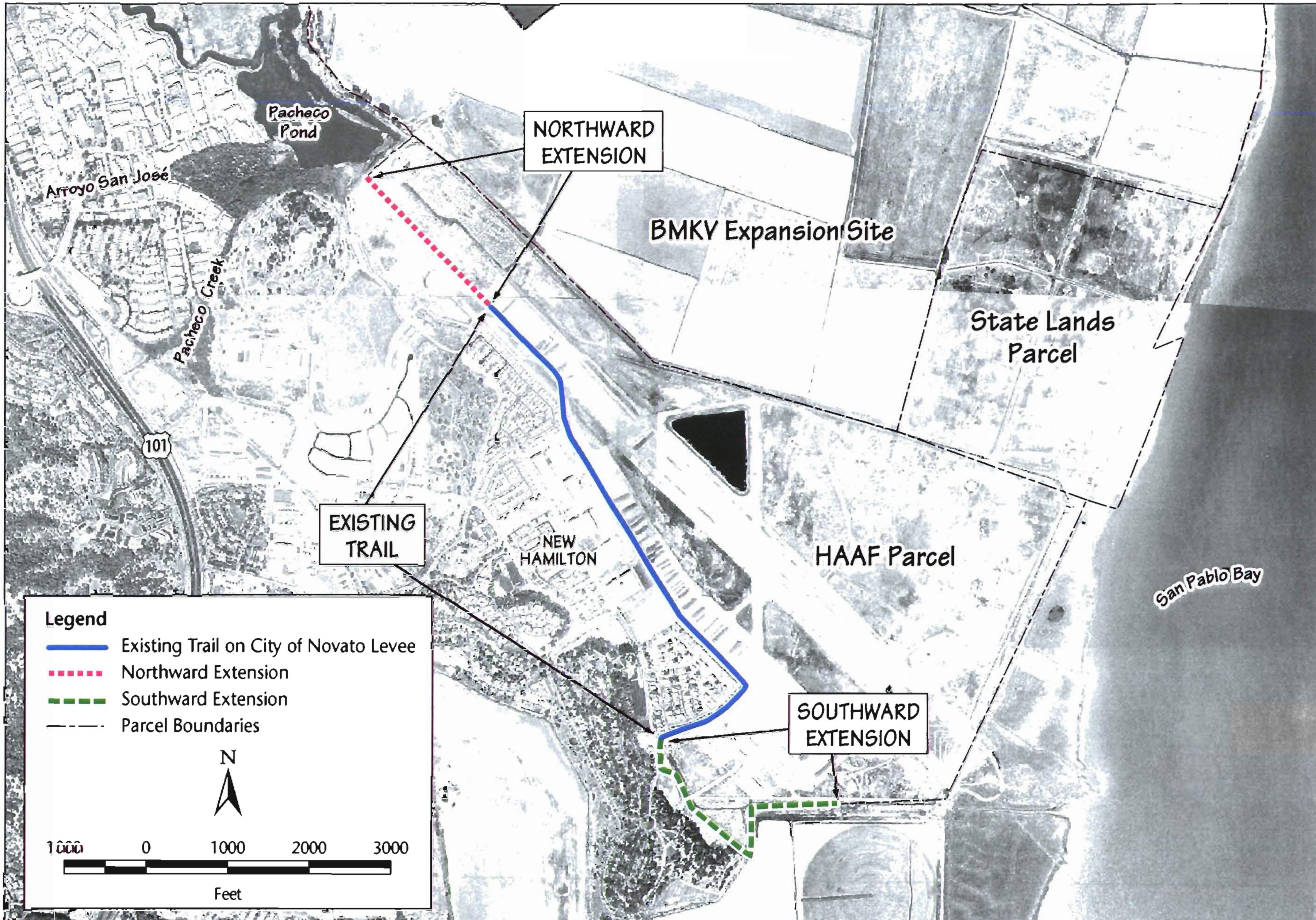

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Figure 4-10
Common Trail Segments at Hamilton, All Alternatives

above, and Mitigation Measure BIO-1 should be implemented to reduce this impact to less than significant.

Impact BIO-28: Disruption of Sensitive Wildlife due to Public Access Interactions along the Bay Trail

All of the alternatives include extending the Bay Trail along the southwest perimeter of the HWRP and northward from the City of Novato levee to Pacheco Pond. Each alternative includes a unique route for the Bay Trail from the south side of Pacheco Pond to Bel Marin Keys Boulevard. In addition, Alternatives 1 and 3 include a spur option to extend a trail to Novato Creek through BMKV. Each alternative has the potential for disruption of sensitive wildlife by public access in proximity to sensitive wetland habitat that exists at present in and around Pacheco Pond. Alternatives 1 and 3 spur options could also result in access-related disturbance to existing sensitive habitat in Novato Creek. In addition, future public access would be adjacent to wetland areas created as part of the restoration project, which is a concern in achieving the project objective of "creating and maintaining wetland habitats that sustain viable wildlife populations." However, as noted in the discussion above, impacts to future habitats are assessed in the context of the habitats present today and the net changes that result from each alternative.

The specifics of each Bay Trail or spur option route and its potential construction and access impacts are discussed later in this section under impacts unique to each alternative. The following discussion presents information about the general nature of potential access-related impacts for all 3 restoration alternatives.

In 1996 independent scientific consultants to the Bay Trail Project undertook an extensive literature search for material that addressed public-trail-related impacts on wildlife, in preparation for a scientific field study (Sokale and Trulio 1996). Out of hundreds of abstracts that were reviewed by consultants to the Bay Trail Project, only 25 were found that specifically addressed the topic of human-disturbance impacts on wildlife. Moreover, only 8 of those 25 were field studies that directly assessed impacts of trail-related activity on wildlife. The conclusions drawn from these studies were varied, though the 8 field studies all showed some adverse impact on wildlife from trail activity (San Francisco Bay Conservation and Development Commission 2001).

The most common responses reported were animals moving away in response to human activity, and changes in species diversity and abundance near trails. Six of the studies reported immediate effects on animal behavior, such as moving away from the trail when users approached the study site. Only 1 study was done in the San Francisco Bay Area. That study looked at the amount of human disturbance at 4 wetland sites and found that, as human disturbance at a site increased, the number of birds decreased. The study did not compare the study

sites to control sites (San Francisco Bay Conservation and Development Commission 2001).

The San Francisco Bay Trail Project is currently conducting a scientific study of the potential effects of non-motorized recreational trails on shorebirds and waterfowl that use mudflat foraging habitat adjacent to the San Francisco Bay Trail. The study is being conducted at 3 sites in the Bay Area and includes trail and control sites. The study examines impacts to birds in their foraging habitat. Potential effects of trail use on species abundance and diversity adjacent to breeding habitat are not a part of the study. Preliminary findings based on early analyses showed no general relationship between human use of trails and bird abundance or diversity in foraging habitats at the 3 locations studied in the San Francisco Bay Area (San Francisco Bay Conservation and Development Commission 2001).

There are presently many unknowns surrounding the possible effects of public access on wildlife. The initial results of the 2 studies noted above in the San Francisco Bay area are varied.

BCDC prepared a draft report in 2001 that reviews Bay Plan access policies and existing scientific understanding of access/wildlife interactions, and provides guidance concerning design of public access for enhancing wildlife compatibility. Key conclusions of the report include the following.

> "There is evidence that public access may have adverse effects on wildlife. Adverse effects on wildlife from human activities may be both direct (such as harassment or harvest) and indirect (such as habitat modification), and effects can be both immediate and long term. Immediate effects may include: nest abandonment (which may increase risk of predation of eggs or young); flushing; and increased stress, which can lead to reduced feeding or site abandonment. Long-term effects may include decreased reproductive success, decreased population within species, or decreased number of total species. If improperly sited, public access may fragment habitats and serve as predator access routes to wildlife areas."

> "Potential adverse effects from public access can be addressed through the employment of siting, design, and management strategies to avoid or minimize adverse effects, including such strategies as use restrictions, buffers, periodic closures or the prohibition of public access in specific areas. Siting, design and management strategies can be effective in avoiding or reducing adverse effects on wildlife."

> "There is a need for more, well-designed, scientific studies of effects of human activities on wildlife, both on a local scale in the San Francisco Bay Area, and on a national scale in similar habitats with similar recreational uses."

BCDC also reviewed the potential benefits of various siting, design, and management strategies that may be used to avoid or minimize adverse effects of public access on wildlife. These possible strategies include the following (San Francisco Bay Conservation and Development Commission 2001).

- Durable Materials–Construction of durable pathways can reduce erosion and limit creation of alternative access routes that may be unsafe or muddy.
- Varied Access Experiences–Varied and interesting access experience can keep users in designated areas and limit creation of informal routes.
- Spur Trails/Point Access–Limit physical access to sensitive areas while providing users with some access.
- Parking/Staging Access–Location away from sensitive areas can reduce use levels within 0.25 to 0.5 mile from staging areas.
- Buffers and Barriers–Use of vegetation, open space, and fences can provide physical, visual, and/or sound barriers between users and sensitive wildlife.
- Boardwalks/Bridges–Confine access to designated areas while allowing hydrologic connections to be maintained.
- Overlook Points–Provide for visual access while limiting direct contact/proximity.
- Seasonal/Periodic Closures–Reduce potential interactions during breeding or other sensitive wildlife periods.
- Use Restrictions–Control adverse effects of dog access, wildlife feeding, fishing, motorized vehicles, etc.

Although the specific design features for the Bay Trail or spurs to the Bay Trail have not been selected, the potential for access/wildlife impacts is considered a significant impact under all 3 alternatives because of the proximity of existing sensitive habitats and wildlife. The specifics of the potential impacts of each alternative route are discussed later in this section. Regardless of the route selected, Mitigation Measure BIO-11 would be implemented by the Conservancy, Corps, or successors in interest to reduce this impact. In the context of the substantial increases in wetland habitat resulting from the project and with implementation of this measure and the route-specific mitigation measures, the impact of access on sensitive wildlife would be less than significant.

Mitigation Measure BIO-11: Incorporate Wildlife-Sensitive Approaches in Bay Trail Design and Develop Trail Management Plan.

The Conservancy, Corps, or successors in interest will develop the final design for any proposed Bay Trail routes or spur trail options in coordination with BCDC, DFG, USFWS, the County of Marin, the City of Novato, and the Bay Trail project. The specific trail design will include consideration of at least the following strategies (described above in the impact discussion), as appropriate to reduce access conflicts.

- Durable Materials
- Varied Access Experiences

- Point Access (along the designated trail itself)
- Parking/Staging Access
- Buffers and Barriers
- Boardwalks/Bridges
- Overlook Points
- Seasonal/Periodic Closures
- Use Restrictions

In addition, a trail management plan will be developed in cooperation with the same agencies. Specific design and management requirements that have already been identified for each potential route are noted below. Annual monitoring results may identify needs to changes in management of trail use and/or trail restrictions.

Impact BIO-29: Disruption of Sensitive Wildlife due to Public Access Interactions along the Bay Trail, Southward and Northward Extensions

The habitats currently adjacent to the southward extension of the Bay Trail include grassland and developed areas, and a drainage ditch along the southern perimeter levee that appears to contain some riparian vegetation. Salt marsh is located east of the outboard marsh, approximately 700 feet from the proposed terminus of the Bay Trail. With implementation of the HWRP, tidal and seasonal wetlands would be established north of the Bay Trail in this area.

The habitats currently adjacent to the northward extension of the Bay Trail from the City of Novato levee to Pacheco Pond include annual and fescue grasslands. There is a drainage ditch on the south side of Pacheco Pond and west of where the Bay Trail may be routed. With implementation of the HWRP, seasonal wetlands would be established east of the levee on the west side of the HWRP.

Public access along these portions of the Bay Trail has the potential to disrupt existing wildlife that uses the grassland and drainage ditch along the southern trail extension and the grasslands along the northward extension to Pacheco Pond. Because the southern extension of the Bay Trail would stop 700 feet west of the existing salt marsh, access impacts on the existing salt marsh would be less than significant. Future access has the potential to disrupt sensitive wildlife that may utilize the seasonal and tidal wetlands to be created by the HWRP. This impact is considered significant because it would conflict with the project objectives, and Mitigation Measure BIO-12 is recommended to reduce this impact. In the context of the substantial increases in wetland habitat that result from the project and by adding screening and buffer zones around the public access components and the other elements of this measure, the impact associated with access on sensitive wildlife would be less than significant.

Mitigation Measure BIO-12: Implement Specific Design and Management Mitigation for Bay Trail Southward Extension and Northward Extension from City of Novato Levee.

The following will be incorporated into the design and trail management for the southward and northward extension of the Bay Trail from the City of Novato levee.

- Place signage at the terminus of the southward extension trail along the perimeter levees.
- Place physical buffers (such as vegetation), periodic signage, or barriers (such as fencing), as determined in consultation with USFWS and DFG to prevent or discourage public access into areas of sensitive species habitat.
- Prohibit all dog and motorized vehicle access (except for emergency vehicles).
- Consider seasonal closures of the trail spur along the southern perimeter levee during the peak breeding seasons of sensitive species (such as Saltmarsh Common Yellowthroat and California Clapper Rail), in consultation with DFG and USFWS, once the restored seasonal and tidal wetland areas begin to be used by sensitive species.

Impact BIO-30: Changes in Predator Access

At present, the BMKV site provides unimpeded access for predators, such as dogs, red-tailed fox, and raccoons, to the salt marsh outboard of the perimeter levees and the other habitats onsite. Such access may affect the sensitive species found in these marsh areas, such as the California Clapper Rail.

Implementation of one of the restoration alternatives would reduce, but not eliminate predator access to the outboard marsh. Each alternative would include the construction of levees for control of tidal flooding or improvement of existing levees and berms. These levees and berms would continue to provide predator access to portions of the outboard marsh. However, the access across the existing agricultural fields would be impeded due to the introduction of tidal flows across the site, and the perimeter levees would be lowered to an approximate high-tide level, which should reduce predator use and access to portions of the outboard marsh. As noted above, the trail management plan for the Bay Trail and any spur trails built as part of the project would prohibit people from bringing dogs on the site. Because the project would reduce predator access compared to the existing setting, this impact is considered less-than-significant.

The Conservancy or successor in interest would work with USFWS to incorporate predator management into the overall management of the restoration site.

Impact BIO-31: Potential Harm to Marine Mammals, Special-Status Fish Species, and Common Fish Species due to Pile-Driving Activities for Off-Loader Facility and Booster-Pump Platforms

The dredged material off-loading facility and booster-pump platform might be built on piles. Pile-driving activities, if conducted, could disturb marine mammals, sensitive fish species, and/or common fish species near the platforms in San Pablo Bay. The piles that would be used are estimated to be approximately 36 inches wide (.91 meters). Based on the estimated amount of piles necessary, pile-driving activities could take approximately 1 month.

Harbor seals use Sisters Rocks (approximately 2,100 yards south of the location of the off-loading facility) and Castro Rocks, adjacent to the Richmond–San Rafael Bridge, (approximately 7,000 yards southeast) as haul-out sites for resting and breeding. Castro Rocks is the largest haul-out site in the North Bay and the second largest breeding site in the San Francisco Bay. Harbor seals also use Lower Tubbs Island as a haul-out site (approximately 11,000 yards northeast of the approximate off-loading facility).

Several special-status fish species are known to occur or have the potential to occur in the vicinity of the proposed expansion area, including longfin smelt; Central Valley and Central Coast steelhead; winter-run, spring-run, and fall-run chinook salmon; and coho salmon.

Common fish species in San Pablo Bay include jacksmelt, topsmelt, northern anchovy, Pacific herring, bat ray, leopard shark, plainfin midshipmen, white croakers, bay gobies, shiner perch, English sole, speckled sand dab, California halibut, white sturgeon and others (California Department of Fish and Game 2002).Because pile-driving studies have not been completed for equipment of the size proposed for this project, this analysis is based on the results of the pile installation demonstration project (PIDP) that was conducted for the San Francisco–Oakland Bay Bridge East Span Seismic Safety Project (East Span Project) (Caltrans 2001a, 2001b). Caltrans evaluated impacts to marine mammals and special-status fish species resulting from large pile-driving hammers (rated 500 to 1,700 kilojoules [kJ]) (Caltrans 2001a, 2001b). The hammers studied in the PIDP were far larger than the equipment that would be used for this project (estimated to be rated 110 to 220 kJ). Hammers delivering up to 200 kJ are commonly used for marine and near-shore construction around the Bay.

The PIDP for the East Span Project did not identify any apparent effect of pile driving on the Yerba Buena harbor seal haul-out site, which was located approximately 1 mile from the pile-driving activity. Because the nearest haul-out sites are both located more than 1 mile from the approximate location of the HWRP off-loading facility and booster-pump platforms, and the PIDP studied far more powerful pile-driving hammers, pile-driving activity at the platforms is not expected to affect the identified haul-out sites.

Pile-driving activity may disturb harbor seals or other marine mammals swimming in the immediate vicinity of the activity. NMFS considers in-air noise levels below 85 decibels (dB) safe for marine mammals, but the pile-driving activity is likely to result in in-air noise levels in excess of 85 dB. NMFS has determined that elevated underwater sound pressure levels (SPLs) of 180 to 190 dB or higher could cause temporary hearing impairment or threshold shifts in marine mammals, thus disrupting their behavior. In the PIDP for the East Span Project, the 190 dB contour for hammer energy level of 750 kJ was calculated as 185 meters. While not specifically studied, it is reasonable to assume that the 190 dB contour for the pile-driving equipment likely to be used for the HWRP would be far less than 185 meters. Marine mammals in the water in the immediate vicinity of the piles for the proposed expansion would be temporarily displaced if they choose to avoid the area in response to high sound pressure levels. While the specific sound pressure levels of the equipment proposed for pile-driving activity for this project have not been studied, it is assumed that the SPLs may reach or exceed the 190 dB contour, at least in the immediate vicinity of pile-driving activity. This impact is considered potentially significant. Implementation of Mitigation Measure BIO-13 would reduce these impacts. However, even with mitigation, there is the potential for harassment of marine mammals if an individual were to swim immediately adjacent to pile-driving activity. This impact is therefore considered significant and unavoidable, if pile-driving is used.

The PIDP for the East Span Project also documented fish mortality due to contraction and expansion of the swim bladder in an immediate mortality zone approximately 10 to 12 meters from the pile-driving activity. A delayed mortality zone, wherein injury was identified to the inner ear or other fish organs that may result in mortality several hours to several days after injury, was estimated to be located in a radius of at least 150 meters and possibly as large as 1,000 meters (Caltrans 2001b).

While population-level impacts to fish are not expected, pile-driving activity may result in individual mortality in fish species present in the immediate vicinity of pile-driving. For common species of fish, individual mortality of fish is considered a less-than-significant impact.

Regarding listed fish species, the proposed project will provide rearing and refuge habitat in the subtidal channels that will be created within the tidal marsh restoration areas. However, although the effect is limited in duration and scale, there remains a potential for pile-driving to harass individual marine mammals and a potential for individual mortality of listed species. This impact is therefore considered potentially significant. Implementation of Mitigation Measure BIO-13 would reduce this impact. However, even with mitigation, there is the potential for individual mortality of listed fish species immediately adjacent to pile-driving activity. This impact is considered significant and unavoidable, if pile-driving is used and listed species of fish are present in the immediate vicinity of pile-driving activity.

Mitigation Measure BIO-13: Coordinate with Appropriate Federal and State Agencies to Reduce Impact on Marine Mammals and Special-Status Fish Species during Pile-Driving Activities.
The Conservancy, Corps, or successors in interest will consult with NMFS and DFG in order to implement measures to reduce impacts associated with pile-driving activities to marine mammals and special-status fish species. These measures could include but are not limited to the following.

- Scheduling pile-driving activities to occur outside the peak juvenile outmigration periods for chinook and steelhead salmon whenever possible.
- Monitor marine mammals during pile-driving activity, ceasing pile-driving activity temporarily if marine mammals approach within 100 meters.
- Monitor sound attenuation.

Impact BIO-32: Potential Disruption to Nesting Special-Status and Common Birds due to Removal of Several Eucalyptus Groves and Several Oak Trees

Construction activities associated with the proposed wetland restoration, including levee and seasonal wetland construction, would result in the permanent loss of several eucalyptus groves and several individual oak trees located east of Pacheco Pond. Although eucalyptus trees are non-native and abundant, loss of these trees would remove nesting habitat for special-status and common raptors, migratory birds, and other bird species. Eggs and nests of all birds are protected under Section 3503 of the California Department of Fish and Game Code. Other eucalyptus habitat exists just north of this area on Headquarters Hill, where potentially displaced wildlife could relocate to, and in the general area there are ample alternative nesting locations.

The removal of non-native trees and several individual oak trees themselves is considered a less-than-significant effect. A large quantity of non-native trees remaining in an area close to restored seasonal and tidal wetland habitats is considered incompatible with the project goal and objectives because it would (1) hinder the ability to create the seasonal wetland; (2) retain non-natural habitat potentially supporting an unnaturally large amount of raptor roosts; and (3) result in enhanced ability of those raptors to prey on special-status species in the restored habitat areas. While predation is a natural part of the ecosystem, retention of a non-native grove so close to threatened- and endangered-species habitat is not considered supportive of the project goal and objectives.

However, the potential disruption to special-status birds and/or other bird nesting is considered significant. Implementation of Mitigation Measure BIO-14 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-14: Remove Identified Eucalyptus Groves and Oak Trees outside Special-Status and Other Bird Breeding Seasons. During construction, the Conservancy, Corps, or successors in interest will remove trees within the identified eucalyptus groves and individual oak trees outside the breeding season of any identified special-status or other bird species using these trees. This will likely mean that trees will be removed between September 1 and February 1 to protect nesting birds from impacts associated with tree removal.

Impact BIO-33: Potential Disruption to Special-Status Bat Species due to Removal of Structures

Construction of the proposed wetland restoration would require the removal of several existing structures on the project site, including a barn, house, and equipment shed left from past agricultural uses of the site. The structures are all abandoned and dilapidated and pose a hazard on the site, and the house and the equipment shed have only a part of their roofs in place. Reconnaissance of these structures did not conclusively identify bat signs within the structures. However, owls and hawks were observed within the structures. Raptors are common predators on bats, and their presence may decrease the likelihood of bat presence in the structures. Tin roofing, present on the barn structure, does not offer the needed roosting substrate for bats, although the wooden crossbeams present in the barn and the other structures could potentially be used by roosting bats. Because of their construction and proximity to adequate foraging areas, these structures could provide roosting habitat for common and special-status bat species that may to occur in the vicinity of the project site (see table D-1 in appendix D). No known occurrence of bat species has been documented in the recent past, although surveys have not been conducted during different seasons to more accurately determine potential usage. Removal of these structures could result in the loss of potential roosting habitat for any common or special-status bat species that may be using the structures. This impact to special-status bats is considered significant (if bats are actually present). Implementation of Mitigation Measure BIO-15 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-15: Conduct Site Surveys for Presence of Special-Status Bat Species and Remove Structures in accordance with State and Federal Laws.

Surveys for evidence of bat roosting activity will be conducted by a qualified bat biologist during the spring (March–mid May), summer (mid May–mid August) and fall (mid August–mid October) seasons of the year prior to structure removal. A total of 3 surveys will be completed prior to project construction. Surveys will be conducted at least once during each season and will employ the following survey methods.

- Visual inspection of the structures for bat signs such as urine stains and guano.
- If the visual inspections indicate bats are present, emergence surveys will be conducted to determine an estimate of roosting bat numbers.
- If bats are present and the need to identify species is expressed through coordination with DFG, acoustic surveys will be conducted using appropriate bat call analysis software. If bats are not found to be using the structures as roosting habitat, no further mitigation will be required.
- If bats are found to be using the structures as roosting habitat, the bat biologist will consult with the DFG to determine the need for and timing and type of appropriate mitigation measures. These measures may include, but are not limited to, avoidance and/or construction and placement of bat boxes near the structures in combination with accepted means of bat exclusion from the structures. These measures may also include a requirement for limiting construction activities by time of day and season to ensure the least degree of impacts on bats species. Designated measures will be implemented prior to commencement of the wetland construction.

Impact BIO-34: Loss of Agricultural Land

Currently, the project site is mainly composed of agricultural lands that provide habitat for common wildlife as well as foraging habitat for raptors and foraging and resting habitat for other birds. Raptor species use agricultural lands for foraging because rodent prey often congregate in agricultural fields. Agricultural habitats also provide foraging and resting habitat for migrating and wintering waterfowl and shorebirds. With implementation of the proposed wetland restoration, approximately 1,241 acres of existing agricultural lands on the project site would be converted over time to tidal wetlands, seasonal wetlands, and upland habitat. Impacts on agricultural lands are considered less than significant because this habitat is not considered a sensitive community, is prevalent in the local and regional area, and loss of this habitat would not result in a substantial reduction in populations of rare or special-status species. Because construction of the restoration project would occur over time, the wildlife species that inhabit the site would slowly relocate to adjacent habitats that provide similar foraging and resting functions.

Impact BIO-35: Potential Change in Habitats in Pacheco Pond and Tributaries

The restoration alternatives include several actions that may affect habitats currently present in Pacheco Pond and in the confluence area where Pacheco Creek and Arroyo San Jose merge. These include diversion of some or all of the existing outlet flow from Pacheco Pond to Novato Creek to the BMKV site and the expansion of the pond. Impacts on Pacheco Pond related to construction of

or access along the Bay Trail are discussed separately for each alternative below. Impacts on salmonid access were discussed previously under Impact BIO-9.

As noted in chapter 3, a new water management plan would be developed to govern the use of the existing outlet and the proposed outlet to BMKV from the pond. In the dry season, no diversion of flow is expected because of the limited baseflow entering the pond and the expected elevation of the new outlet structure (around 1.5 feet NGVD). Also, under Revised Alternative 2 dry season flow is not desired in the seasonal wetland area. In the wet season, it is expected that some form of dual use of both outlets is likely to occur.

The outlet to the tidal habitat area (Alternatives 1 and 3) or to the seasonal wetland (Revised Alternative 2) would be set at approximately 1.5 feet NGVD to allow management of pond surface water elevations in accordance with the existing pond management agreement between MCFCWCD and DFG. Setting this at a level consistent with current habitats would avert any habitat change at Pacheco Pond resulting from a change in water surface levels. As noted in the discussion in the *Surface-Water Hydrology and Tidal Hydraulics* section above, the addition of the overflow to BMKV during high stage events would lower peak stage. However, by setting the new outlet elevation appropriate with current management, water surface elevations during normal conditions could be consistent with the present elevations. As noted in the *Water Quality* section Mitigation Measure WQ-3, the new management plan, in addition to identifying operational parameters for flood control and habitat conservation, would also include considerations of water quality (such as circulation and dissolved oxygen).

The expansion of the pond and addition of fringing emergent marsh in all the restoration alternatives is expected to increase the amount of open water and emergent marsh habitat available for species that presently use the pond. This is considered a beneficial impact.

Overall, the diversion of some or all of the flow from the existing outlet during the wet season and the expansion of Pacheco Pond is considered to result in a less-than-significant impact on existing habitats in Pacheco Pond.

Impacts and Mitigation Measures Unique to Alternative 1 and Revised Alternative 2

Figures 3-1 and 3-2 (in chapter 3 of this document) illustrate the distribution of habitats restored, 50 years after implementation of the proposed BMKV expansion, under Alternative 1. Figures 3-5 and 3-6 (in chapter 3 of this document) illustrate the distribution of habitats restored, 50 years after implementation of the proposed BMKV expansion, under Revised Alternative 2. Table 4-7 presents a comparison between the estimated extent of habitats restored under Alternative 1 and Revised 2 at year 50 and the expected net

change in the extent of habitats relative to the No-Action Alternative (i.e., existing conditions).

Impact BIO-36: Potential Effects of Construction of and Access to the Interpretive Center and Access Area on the Bulge Parcel West of the HWRP

Under Alternative 1 and Revised Alternative 2, the interpretive center and access area would be located on the land currently owned by the City of Novato just west of the HWRP. This area contains grassland, concrete pads, dirt and gravel roads, and seasonal wetlands in low-lying areas. The proposed location for the interpretive center is in the center of the area between the 2 seasonal wetland areas in an area containing a large concrete pad, grassland, and existing roads. The loss of several acres of the grasslands in this area due to interpretive center construction is considered a less-than-significant impact because of the availability of other grassland nearby and the relative abundance of this type of habitat. Because of potential nesting in and adjacent to the interpretive center location in the grasslands or seasonal wetlands, Mitigation Measures BIO-1 and BIO-5, described above, should be implemented during construction.

Vehicle and foot access to the interpretive center and access between the interpretive center and the nearby portion of the Bay Trail could affect habitats along the access routes and/or species that may use the adjacent seasonal wetlands. The following mitigation measures should be incorporated into the final design of the interpretive center and access routes, if built at this location, to reduce impacts of construction and access on biological resources to less than significant.

Mitigation Measure BIO-16: Recommended Mitigation Measures for Construction of and Access to and from the Interpretive Center and Access Area on the Bulge parcel west of HWRP.

The following measures are recommended to the parties that construct and operate the interpretive center, if located on the Bulge parcel immediately west of the HWRP seasonal wetland area.

- The temporary and permanent footprint of the interpretive center, improvements, access roads, and foot trails should be placed in previously disturbed areas (such as existing concrete pads and along existing roads) whenever feasible. The temporary and permanent footprint should be located outside of the delineated seasonal wetlands. The existing roads that lead to the central area from the south, and north from the central area to the future location of the new levee should be used for access wherever feasible.
- During construction, sediment fencing should be used to prevent erosion and sediment from entering the neighboring seasonal wetlands and to prevent inadvertent construction access into these areas.

- Physical buffers (such as vegetation), barriers (such as fencing), or periodic signage) should be placed between the improved areas (the interpretive center ,the access road, and trail segments) and the adjacent seasonal wetland areas, as appropriate and necessary to prevent access.
- Dog use should be prohibited at the interpretive center and on the connecting trails to prevent impacts on species that may use adjacent seasonal wetlands.

Impact BIO-37: Potential for Construction-Related Mortality of Chinook Salmon, Central Valley Steelhead, and Longfin Smelt

Operation of the hydraulic off-loader intake pumps from either of the proposed deep-water or shallow-water locations in San Pablo Bay could potentially result in mortality of longfin smelt or chinook salmon and Central Valley steelhead salmon smolts during out-migration (smolts of these species could be present in San Pablo Bay from about January 1 to June 30). These species could face mortality if fish are entrained in pump intakes. However, because pumping operations are temporary and water would be pumped from the open waters of San Pablo Bay rather than from a narrow water body (which could result in channeling fish to the pump intakes), it is unlikely that these species would be entrained by pump operation. Therefore, this impact is considered less than significant, and no mitigation is required.

Impact BIO-38: Temporary Disturbance of Fish in San Pablo Bay during Construction

Transporting dredged material to the site would require pumping the material through the dredged-material pipelines across part of San Pablo Bay from hydraulic off-loaders, also located in the Bay. This process could increase the turbidity surrounding the hydraulic off-loaders and create the potential for fuel spills, thereby causing a disturbance to the fish species in the area. Fish are likely to move out of the area, however, until the water quality increases. All construction activities must meet the objectives established by the San Francisco RWQCB. However, drawing of water to use in slurry of dredged material pumped to the expansion site may result in fish entrainment. To further reduce the likelihood of fish entrainment or if resource agencies determine it to be necessary, the Conservancy or successor in interest would implement Mitigation Measure BIO-17.

Mitigation Measure BIO-17: Use Fish Screens to Prevent Possible Entrainment of Fish.

The Conservancy, Corps, or successors in interest will install fish screens or other appropriate fish exclusion devices to prevent entrainment of fish into the water intakes of the hydraulic off-loader pump. Fish screens or other exclusion

devices will be designed to ensure intake velocities do not result in the impingement of fish onto the screen or result in other scenarios which harm fish.

Impacts and Mitigation Measures Unique to Alternative 1

Impact BIO-39: Disruption of Sensitive Wildlife due to Bay Trail Construction, Alternative 1 and Spur Option 1A

The Bay Trail would be constructed through the wetland/riparian area at the confluence of Arroyo San Jose and Pacheco Creek, where the creeks enter Pacheco Pond, then along the Marin County Flood Control service road around the west side of Pacheco Pond (see figure 3-1 in chapter 3 of this document). From this point, the trail would be routed through the wetlands area on the west side of Pacheco Pond and would cross the channel via bridge to Bel Marin Keys Boulevard.

Construction would require extensive in-water work and permanent loss of wetland/riparian areas along the route. Across the Arroyo San Jose/Pacheco Creek confluence, assuming a 50-foot width of disturbance, construction could result in loss of approximately 0.8 to 1.7 acres of wetlands depending on trail route. Construction along the western edge of the wetlands near Bel Marin Keys Boulevard could result in additional loss of approximately 1.1 acres of wetlands, assuming a 50-foot width of disturbance. Permanent loss would depend on the width of boardwalk or bridge structures utilized. In-water work could affect aquatic and riparian species found in and adjacent to the proposed route and could temporarily increase sedimentation and turbidity in Pacheco Pond. Construction noise and activity could also affect foraging and breeding behavior of fish and wildlife species that utilize Pacheco Pond and the lower portions of the 2 feeding creeks.

Placement of a trail through the wetland/riparian area at the southwest end of Pacheco Pond would create a physical disruption to the existing wetland/pond interface or within the wetland/riparian area, depending on routing. The trail would require at least 1 and possibly 2 or more bridge segments in the confluence area and an approximately 200-foot bridge to reach Bel Marin Keys Boulevard across the outlet channel of Pacheco Pond.

Spur Option 1A would be constructed on areas previously disturbed by other site preparation and construction. Construction of the trail itself, if it occurred before wetland creation/levee breaching, would not be expected to result in any additional impacts to sensitive wildlife beyond those already described for general site construction activities. If trail construction were to occur after restored wetlands have established or begun to be established, then the mitigation proposed above, including Mitigation Measures BIO-1, 3, 4, 5, and 6, will be

applied to trail-construction activities. With implementation of this mitigation, the construction impact of Spur Option 1A is considered less than significant.

Given the presence of wetland, riparian, and aquatic environments along the potential route, the impact of construction of the Bay Trail west of Pacheco Pond is considered significant. Mitigation Measures BIO 1, 3, and 5, described above, are recommended as mitigation for this alternative. In addition, Mitigation Measure BIO-18 is recommended for this alternative.

Mitigation Measure BIO-18: Implement Specific Design and Management Recommendations for Construction of Trail West of Pacheco Pond.

The following will be incorporated into construction plans if the Bay Trail route under Alternative 1 is implemented.

- Contribute to future riparian restoration efforts on Pacheco Creek or Arroyo San Jose Creek in a manner sufficient to offset loss of riparian habitat brought about by construction and installation of trail across confluence.
- Carry out construction outside of the peak breeding seasons of sensitive species (such as salt marsh common yellowthroat) and migratory waterfowl, in consultation with DFG and USFWS.
- Minimize use of fill as foundations for bridge and boardwalk structures in wetland areas, where feasible.
- Incorporate best management practices during construction to prevent sedimentation of the wetland areas.
- Provide design plans to DFG and USFWS prior to construction to determine any additional mitigation necessary to reduce impacts on species using confluence area and Pacheco Pond.

Impact BIO-40: Disruption of Sensitive Wildlife due to Public Access Interactions along Bay Trail, Alternative 1

The Bay Trail under Alternative 1 would be adjacent to the open water and wetland habitat of Pacheco Pond and would be within the riparian/wetland habitat at the confluence of Pacheco Creek and Arroyo San Jose. No separation between the trail and the riparian/wetland habitat is possible, unless the trail is moved onto a boardwalk across the open water area of Pacheco Pond for which the feasibility is unknown. The route along the existing service road would be near the western edge of Pacheco Pond and associated wetlands. The route north from the end of the service road to Bel Marin Keys Boulevard would be on a boardwalk over the wetlands adjacent to the Pond outlet. Given the proximity of the trail route to these environments, the feasibility and efficacy of buffering approaches is limited.

Lacking buffers or separation, public access is more likely to disrupt wildlife use of immediately adjacent environments around Pacheco Pond. In particular, bird breeding activity in and adjacent to Pacheco Pond would be affected by public access.

Given the presence of wetland, riparian, and aquatic environments immediately adjacent to the potential route, the impact of access is likely to be significant. Mitigation Measures BIO-12, BIO-19a, and BIO-19b are recommended to reduce this impact. In the context of the substantial increases in wetland habitat resulting from the project and with implementation of these measures, the impact of access on sensitive wildlife would be less than significant.

Mitigation Measure BIO-19a: Implement Specific Design and Management Recommendations for Bay Trail Alternative 1.
The following will be incorporated into the design and trail management plan if the Bay Trail route in Alternative 1 is implemented.

- Place physical buffers (such as vegetation), barriers (such as fencing), or periodic signage between the trail and Pacheco Pond, where appropriate and necessary.
- Prohibit all dog access.
- Prohibit fishing and boating access from the trail to Pacheco Pond (fishing, swimming, and boating are presently prohibited at the pond).
- Consider seasonal closures of the trail spur during peak breeding seasons of sensitive species (such as Saltmarsh Common Yellowthroat) or other species that use the confluence area, in consultation with DFG and USFWS.

Mitigation Measure BIO-19b: Implement Specific Design and Management Recommendations for Spur Option 1A.
The following will be incorporated into the design and trail management plan if Spur Option 1A is implemented.

- Locate trail a minimum of 300 feet from tidal marsh habitat.
- Locate trail on the northern slope of the central crossing levee to avoid direct visual and physical proximity to restored tidal wetlands areas. Provide periodic point access to the top of the levee for visual access.
- Place physical buffers (such as vegetation), barriers (such as fencing), or periodic signage, where appropriate and necessary, between the trail and the tidal marsh habitat and between the trail and Pacheco Pond
- Impose gated access to prevent public access to the NSD access road/berm between BMKV and the HAAF site.
- Place a physical barrier of fencing or other suitable material between the trail and Novato Creek to prevent all access to the creek from the trail.

- Monitor wetland restoration development to determine if and when California clapper rails, California black rails, or other sensitive bird species begin using restored tidal marsh for breeding.
- Consider seasonal closures of the trail spur during peak breeding seasons of the California clapper rail and California black rail. Consider additional seasonal closures for other special-status species (such as salt marsh common yellowthroat and San Pablo song sparrow), in consultation with DFG and USFWS.
- Prohibit dog access along the spur trail.
- Prohibit fishing and boat access from trail terminus to Novato Creek and from Novato Creek to trail.

Impacts and Mitigation Measures Unique to Revised Alternative 2

Impact BIO-41: Disruption of Sensitive Wildlife due to Bay Trail Construction, Revised Alternative 2

The Bay Trail under Revised Alternative 2 would be located along the levee between Pacheco Pond and the HAAF site, along the levee between Pacheco Pond and the BMKV expansion area, and across upland areas around the west side of Headquarters Hill leading to Bel Marin Keys Boulevard (see figure 3-5 in chapter 3 of this document). Because the Bay Trail route under this alternative would be constructed on areas previously disturbed by other site preparation and construction, construction of the trail itself, if it occurred before wetland creation/levee breaching, would not be expected to result in any additional impacts to sensitive wildlife beyond those already described for general site construction activities. If trail construction were to occur after restored wetlands have established or begun to be established, then the mitigation proposed above, including Mitigation Measures BIO-1, 3, 4, 5, and 6, should be applied to trail-construction activities. With implementation of this mitigation, as necessary, this impact is considered less than significant.

Impact BIO-42: Disruption of Sensitive Wildlife due to Bay Trail Access, Revised Alternative 2

The Bay Trail under Revised Alternative 2 would be adjacent to the western side of the HAAF parcel, Pacheco Pond, the BMKV seasonal wetland restoration area, Headquarters Hill, and upland areas. This proximity may create public access conflicts with sensitive wildlife as discussed above.

Mitigation Measures BIO-12 and BIO- 20 are recommended to reduce this impact. In the context of the substantial increases in wetland habitat resulting

from the project and with implementation of these measures, the impact of access on sensitive wildlife would be less than significant.

Mitigation Measure BIO-20: Implement Specific Design and Management Recommendations for Bay Trail Revised Alternative 2. The following will be incorporated into the design and trail management plan if the Bay Trail under Revised Alternative 2 is implemented.

- Place physical buffers (vegetation), barriers (such as fencing), or periodic signage) between the trail and Pacheco Pond and between the trail and the restored seasonal wetland area, as appropriate and necessary.
- Impose gated access to prevent public access to the NSD access road/berm between BMKV and the HAAF site.
- Prohibit all dog access.
- Prohibit fishing and boating access from the trail to Pacheco Pond (fishing, swimming, and boating are presently prohibited at the pond).

Impacts and Mitigation Measures Unique to Alternative 3

Impact BIO-43: Disruption of Sensitive Wildlife due to Bay Trail Construction, Alternative 3 and Spur Option 3A

The Bay Trail under Alternative 3 would be located along the levee between Pacheco Pond and the HAAF parcel, along the levee around the east side of the expanded Pacheco Pond, and across upland areas leading to Bel Marin Keys Boulevard (see figure 3-8 in chapter 3 of this document). Spur Option 3A would add a trail from the east side of Pacheco Pond to Novato Creek on the new levee south of the BMK south lagoon levee.

Because the Bay Trail route under this alternative and Spur Option 3A would be constructed on areas previously disturbed by other site preparation and construction, construction of the trail itself or Spur Option 3A, if it occurred before wetland creation/levee breaching, would not be expected to result in any additional impacts to sensitive wildlife beyond those already described for general site construction activities. If trail construction were to occur after restored wetlands have established or begun to be established, then the mitigation proposed above, including Mitigation Measures BIO-1, 3, 4, 5, and 6, should be applied to trail-construction activities. With implementation of this mitigation, as necessary, this impact is considered less than significant.

Impact BIO-44: Disruption of Sensitive Wildlife due to Bay Trail Access, Alternative 3 and Spur Option 3A

The Bay Trail under Alternative 3 would be adjacent to the HAAF site, the expanded Pacheco Pond, and upland areas. Spur Option 3A would be adjacent to the BMKV tidal wetland restoration and to Novato Creek. This proximity may create public access conflicts with sensitive wildlife as discussed above. Spur Option 3A would place a trail closer to the restored tidal wetland than in either of the other 2 alternatives because there is no upland buffer on the outboard side of the new levee.

Mitigation Measures BIO-12, BIO- 21a, and BIO 21b would also be necessary to reduce this impact to a less-than-significant level. In the context of the substantial increases in wetland habitat resulting from the project and with implementation of these measures, the impact of access on sensitive wildlife would be less than significant.

Mitigation Measure BIO-21a: Implement Specific Design and Management Recommendations for Bay Trail Alternative 3.
The following will be incorporated into the design and trail management plan if the Bay Trail Alternative 3 is implemented.

- Locate trail on the eastern slope of the expanded Pacheco Pond levee to avoid direct, constant physical proximity to Pacheco Pond. Provide periodic point access to the top of the levee for visual access.
- Place physical buffers (such as vegetation), barriers (such as fencing), or periodic signage between the trail and the expanded Pacheco Pond, as appropriate and necessary.
- Impose gated access to prevent public access to the NSD access road/berm between BMKV and the HAAF site.
- Prohibit all dog access.
- Prohibit fishing and boating access from the trail to Pacheco Pond (fishing, swimming, and boating are presently prohibited at the pond).

Mitigation Measure BIO-21b: Implement Specific Design and Management Recommendations for Trail Spur Option 3A.
The following will be incorporated into the design and trail management plan if Option 3A is implemented.

- Locate trail a minimum of 300 feet from existing and future tidal marsh habitat.
- Locate trail on the western slope of the levee that is south of the BMK south lagoon levee to avoid direct visual and physical proximity to restored tidal wetlands areas. Provide periodic point access to the top of the levee for visual access.

- Place physical buffers (such as vegetation), barriers (such as fencing), or periodic signage between the trail and the tidal marsh habitat, as appropriate and necessary. Place a physical buffer of fencing or other suitable material between the trail and Novato Creek to prevent all creek access from the trail.
- Monitor wetland restoration development to determine if and when California clapper rails, California black rails, or other sensitive bird species begin using restored tidal marsh for breeding.
- Consider seasonal closures of the trail spur during peak breeding seasons of the California clapper rail and California black rail. Consider additional seasonal closures for other special-status species (such as salt marsh common yellowthroat and San Pablo song sparrow), in consultation with DFG and USFWS.
- Prohibit dog access along the spur trail.
- Prohibit fishing and boat access from trail terminus to Novato Creek and from Novato Creek to the trail.

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Land Use and Public Utilities

Affected Environment

Data Sources

The following documents and policies were used to prepare this section.

- *Marin Countywide Plan and Marin County Zoning Code* (Marin County Community Development Agency 1994)
- *City of Novato General Plan* (City of Novato 1996)
- *Bay Trail Plan* (Association of Bay Area Governments 1989)
- *Long-Term Management Strategy Plan* (1996)
- *San Francisco Bay Area Wetlands Ecosystem Goals Project* (1998)
- *San Francisco Bay Plan* (San Francisco Bay Conservation and Development Commission 1969, as amended)
- Coastal Zone Management Act

Land Ownership

Land ownership in the vicinity of the proposed expansion is described below. If development associated with the BMKV expansion is carried out on lands not owned by the project sponsors, owner approval will be required prior to implementation of any development activities.

Federal and State Ownership

The BMKV expansion site is owned by the Conservancy. The SLC parcel is owned by the State Lands Commission. The HAAF parcel is owned by the Corps.

Local and Private Ownership

Pacheco Pond is owned by MCFCWCD. The City of Novato owns portions of Ammo Hill and the Bay Trail. Headquarters Hill is under private ownership.

Regulatory Setting

Marin Countywide Plan

The Marin Countywide Plan (MCP) is a long-range comprehensive plan that governs growth and development in the unincorporated areas of the county. The proposed BMKV expansion site falls within this jurisdiction. The Marin County Community Development Agency (MCCDA) is the party responsible for administering the MCP. According to MCCDA staff, the proposed wetland restoration project is not considered a "development" in the context of the MCP (Marin County Community Development Agency 2002 see Comment letter L-9 in Responses to Comment volume). Based on this interpretation, the project would not be subject to the MCP policies for development, including those related to agriculture. However, in response to public comment on the project's consistency with MCP policies, this section reviews key MCP policies relevant to the project. Appendix J provides a more comprehensive review of project consistency with MCP policies. The county land use designations relevant to the expansion site are discussed in a separate section below. Flood zoning is discussed separately above in the *Surface Water Hydrology and Tidal Hydraulics* section.

Key policies and programs governing land uses on the expansion site are listed below.

- **Policy EQ-2.42: Wildlife and Aquatic Habitats.** The County shall preserve and enhance the diversity of wildlife and aquatic habitats found in the Marin County bayfront lands, including tidal marshes, seasonal marshes, lagoons, wetlands, agricultural lands, and low-lying grasslands overlying historical marshlands.
- **Policy EQ-2.43: Development and Access Limitations in Bayfront Conservation Areas.** Development shall not encroach into sensitive wildlife habitats, limit normal range areas, create barriers which cut off access to food, water, or shelter, or cause damage to fisheries or fish habitats. Buffer zones between development and identified or potential wetland areas shall be provided. Access to environmentally sensitive marshland and adjacent habitat shall be restricted, especially during spawning and nesting seasons.
    - Program EQ-2.43a: Wetland Impact Mitigation. Development should be sited to avoid wetland areas so that the existing wetlands are preserved. The next priority would be to restore or enhance the wetland environment on-site, provided that no net loss of wetlands occurs. Restoration of wetlands off-site should only be allowed when it has been demonstrated that on-site restoration is not possible and there is no net loss of wetlands. For each acre of wetland lost, two acres shall be restored and should be of the same type of wetland habitat as that which was lost.

- Program EQ-2.43b: Reduce Impacts to Wetlands. All technically feasible measures will be taken to reduce impacts and losses to the original wetland.
- Program EQ-2.34c: Criteria for Evaluating Projects. The following criteria shall be considered when evaluating development projects which may impact wetland areas and should be incorporated into mitigation measures:
  - No net losses shall occur in wetland acreage, functions, and values.
  - Mitigation should be implemented prior to, or concurrently with, the project component which is causing the adverse impact.
  - An area of adjacent upland habitat should be provided for wetland species that require such habitat.
  - Mitigation sites should be permanently guaranteed for open space and wildlife habitat purposes.
  - Mitigation for wetland destruction should be implemented on an on-wetland site, or historical wetland site.
  - Restoration of wetlands is preferred to creation of new wetland areas, due to the greater likelihood of success.
  - Mitigation projects should minimize the need for long-term maintenance and operational manipulation (dredging, artificial water level controls, etc.). Self-sustaining projects are encouraged.
  - All plans to mitigate or minimize adverse impacts to wetland environments shall include provisions to monitor the success of the restoration project. The measures taken to avoid adverse impacts may be modified if the original plans prove to be unsuccessful. Performance bonds may be required.
  - Mitigation must be commensurate with adverse impacts of the wetland alternation and consist of providing similar values and greater wetland acreage than those of the wetland area adversely affected. All restored or created wetlands shall have the same or equivalent habitat value as the wetland lost.
- Program EQ-2.43d: Establish Criteria for Buffer Zones. The County Community Development Agency shall establish criteria for determining the size of upland habitat areas (buffer zones) between development and wetland areas to be used in review of individual development applications.

- **Policy EQ-2.44: Tidelands Subzone.** The purpose of this subzone is to define those areas which should be left in their natural state because of their biological importance to the estuarine ecosystem. The County shall prohibit diking, filling, or dredging in areas subject to tidal action (Tidelands subzone) unless the area is already developed and currently being dredged. Current dredging operations for maintenance purposes may continue subject

to environmental review, if necessary. In some cases, exceptions may be made for areas which are isolated or limited in productivity. In tidal areas, only land uses which are water-dependent shall be permitted, as consistent with federal, state, and regional policy. These include, but are not limited to: ports; water-related industry and utilities; essential water conveyance; wildlife refuge; and water-oriented recreation. Exemptions may be granted for emergency or precautionary measures taken in the public interest, e.g., protection from flood or other natural hazard. Removal of vegetation shall be discouraged. Alteration of hydrology should only be allowed when it can be demonstrated that the impact will be beneficial or non-existent.

- **Policy EQ-2.45: Diked Historic Marshlands Subzone.** The County shall through its land use and development regulations, foster the enhancement of the wildlife and aquatic habitat value of the diked historic marshlands subzone. Land uses which provide or protect wetland or wildlife habitat, and which do not require diking, filling, or dredging, shall be encouraged. These uses include, but are not limited to restoration to tidal status; restoration to seasonal wetlands; agricultural use; flood basin and wastewater reclamation area. In addition, other uses which do not require diking, filling, or dredging, may be allowed if such uses are consistent with the zoning designation and it can be demonstrated that impacts to the bayfront environment are minimized and mitigated. When development is proposed, priority should be given to water oriented uses such as public access and low intensity passive recreational and educational opportunities.
- **Policy EQ-2.46: Freshwater Habitats.** Freshwater habitats in the bayfront areas associated with freshwater streams and small former marshes should be preserved and/or expanded so that the circulation, distribution, and flow of the fresh water supply is facilitated.
- **Policy EQ-2.47: Use of Flood Barriers for Seasonal Habitat.** Natural or managed flood basins should be utilized to provide seasonal habitat for waterfowl and shorebirds.
- **Policy EQ-2.49: Planned District Development Review with Environmental Assessment.** The County shall review all proposed development within the Bayfront Conservation Zone in accordance with the planned district review procedure in order to ensure maximum possible habitat restoration and protection. An Environmental Assessment of existing environmental conditions (biologic, geologic, hazard, and aesthetic) shall be required prior to submittal of development plans.
- **Policy EQ-2.50: Coordination with Trustee Agencies within Bayfront Conservation Areas.** The County shall facilitate consultation and coordination with the trustee agencies (Department of Fish and Game, U.S. Fish and Wildlife Service, the Corps of Engineers, EPA, Regional Water Quality Control Board, and BCDC) during environmental review and during review of other proposals for lands within the Bayfront Conservation Zone.
  - Program EQ-2.50a: Early Consultation with Other Agencies. Any development within the Bayfront Conservation Zone is subject to the

review, and possibly the permit process, of federal and state agencies with jurisdiction over wetlands. It is critical that the applicant consult with these agencies at the very outset of a development project. The County will make every effort to coordinate its review process with the review process of other agencies, consulting with them on the environmental assessment and the master plan. The applicant will be informed at the first contact with the Community Development Agency which other agencies are likely to claim jurisdiction and what the policies and standards of those agencies are regarding development activities in the Bayfront Conservation Zone.

- **Policy EQ-2.51: Minimal Impacts Within Bayfront Conservation Zone.** The County shall ensure that development in the County occurs in a manner which minimizes the impact of earth disturbance, erosion, and water pollution within the Bayfront Conservation Zone.
- **Policy EQ-2.52: Disruption to Runoff and Stream Flow.** Disruption or impediment to runoff and stream flow in the watersheds of Marin County marshes should not be permitted if an environmental assessment indicates that the quality of the water entering the marshes and bay would be diminished.
- **Policy EQ-2.54: Tides and Currents.** The development of jetties, piers, outfalls, etc., should not be allowed to alter the movement patterns of the bay's tides and currents, such that significant adverse impacts would result.
- **Policy EQ-2.55: Bay Fill.** The County shall discourage any bay fill that diverts and retards currents, increases the deposition of sediments, or causes erosion and pollution.
- **Policy EQ-2.58: Protection of Existing Agricultural Lands.** The County shall protect existing agricultural lands in the Bayfront Conservation Zone. These lands are identified as an important resource for the County because they are a visual and scenic resource; play an integral role in other agricultural and dairy operations in Marin County; are a productive economic resource; and are compatible with water-related wildlife habitat. Such agricultural activities could consist primarily of grazing operations and crop production harmonious with adjoining marshes, wetlands, grasslands, or other sensitive lands. Agricultural lands provide habitat for many wildlife species. These habitats may be important for migratory species during times of flood and after silage has been cut.
- **Policy EQ-2.60: Pesticides, Insecticides and Similar Materials.** The County will encourage the use of integrated pest management practices to control pests with the least possible hazard to people, property, and the environment. It is a suggested goal of the County to urge the reduction in the use of pesticides and chemical treatments whenever possible. Non-toxic strategies for pest control, such as modifying habitats, using physical controls, and biological controls are encouraged as an alternative to chemical treatment.

- **Policy EQ-2.61: Consistency with Environmental Hazards Element.** Any development proposed for lands within the Bayfront Conservation Zone must be consistent with policies and proposals of the Environmental Hazards Element, including avoidance of areas that pose hazards such as: differential settlement; slope instability; liquefaction; ground shaking; ground rupture; tsunami; and other types of ground failures.
- **Policy EQ-2.62: Areas Underlain by Deposits of Bay Muds.** Those areas underlain by deposits of "young muds" should be reserved for water-related recreational opportunities, habitat, open space, or limited development subject to approval by the Corps of Engineers and other trustee agencies.
- **Policy EQ-2.63: Sites with Poor Soils Conditions or Seismically Active.** Any development (within watershed areas) proposed for sites that have poor soil conditions for construction or that are seismically active should be designed to minimize: earth disturbance; erosion; water pollution; and hazards to public safety.
- **Policy EQ-2.64: Land Uses in Floodplains.** Areas defined as floodplain should serve the dual purpose of habitat and flood protection. Areas should be evaluated periodically to determine whether increases in the volume and rate of runoff from urbanization or natural forces warrant further flood mitigation measures.
- **Policy EQ-2.65: 100-year Floodplain.** The County's regulatory procedures should reflect 100-year floodplain areas as determined by the Federal Emergency Management Agency (FEMA).
- **Policy EQ-2.66: Use of Shoreline Areas.** Public use of shoreline areas is desirable and should be encouraged consistent with ecological and safety considerations.
- **Policy EQ-2.67: Ensuring Public Access of Shoreline Areas.** The County shall ensure that public access is provided and protected along the bayfront and significant waterways. Public access should be allowed only where access can be accommodated without damaging wildlife habitat.
- **Policy EQ-2.68: Public Access Easements.** The County will accept, as resources permit, public access easements where the offered easement is in a developed area and substantial use could be expected by local residents. Where the County accepts an easement, it will be responsible for signing, providing appropriate facilities, and maintaining the easement. If the County does not accept an easement, it shall attempt to find appropriate public or private agencies to do so.
- **Policy EQ-2.69: Evaluation of New Public Access Areas.** The County shall evaluate potential new public access areas in order to determine the feasibility of providing access and the priorities for acquisition, based on the following criteria: desirability of the site; capacity to sustain use without significant adverse impacts on the bayfront habitat and wildlife; potential for hazard to public safety or health; availability of other public access points in the area; and compatibility with adjacent land uses.

- **Policy EQ-2.70: Siting and Design of Public Access.** Public access should be sited and designed to facilitate public use and enjoyment of the bayfront lands, along with protection of wildlife habitat. Where possible, buffers and upland habitat should remain, or be constructed, between wetland habitats and public use areas. Public areas should be clearly marked, and continuous ten-foot walkways from the nearest roads to the shoreline and along the shoreline should be provided. Public access areas should be designed to minimize possible conflicts between public and private uses on the properties. In general, walkways should be set back at least ten feet from any proposed structure. Public access shall be designed to avoid disturbance of wetlands and sensitive wildlife habitat areas.

- **Policy EQ-2.71: Wildlife, Recreation, and Educational Uses.** Within the Bayfront Conservation Zone, provisions should be made for: recreational development; access to the shoreline for uses such as fishing, boating, hunting, picnicking, hiking, and nature study; separated wildlife preserves. Appropriate means of providing public education on the value of shoreline preservation and the shoreline shall be encouraged.

- **Policy A-1.1: Preservation of Agricultural Lands.** Agricultural lands shall be preserved by maintaining agricultural parcels in sizes large enough to sustain agricultural production, avoiding conversion of agricultural land to non-agricultural uses, discouraging uses which are not compatible with long term agricultural productivity, and encouraging programs that assist agricultural operators and owners in maintaining the agricultural productivity of their land and marketing their products.

- **Policy A-1.6: Agricultural Lands in the Bayfront Conservation Zone.** Recognizing that agricultural land is a non-renewable resource, the County will, to the extent feasible and legal, preserve productive agricultural land in the Bayfront Conservation Zone of the City-Centered Corridor. Development projects which would affect such lands should be designed to minimize loss of productive agricultural land and/or mitigate impacts on agricultural production.

    - Program A-1.6a: Identify Agricultural Lands in the Bayfront Conservation Zone. The County shall identify productive agricultural lands in the Bayfront Conservation Zone which might be kept in agricultural production.

- **Policy A-1.7: Intensity of Agricultural Use.** On lands located in the Bayfront Conservation Zone which are suitable for agricultural preservation, the County should encourage intensive agriculture for food production, in addition to traditional agricultural uses like dairying and hay production. Such innovative programs should be consistent with wetlands and habitat preservation policies.

- **Policy A-1.8: Bayfront Conservation Zone (BFC).** The County will continue to observe BFC Zone policies for agricultural lands in the BFC Zone. These policies call for the protection of existing agricultural land as a valuable county resource.

City of Novato General Plan

The City of Novato General Plan is a comprehensive long-range planning document that identifies the city's land use, transportation, environmental, economic, fiscal, and social goals and policies as they relate to the conservation and development of land in Novato. The SLC parcel is located within the City of Novato. Portions of the Bay Trail routes west of HAAF and BMKV are within the City of Novato. Key policies related to the site include:

- **EN Policy 11 Bayland Overlay Zone.** Establish a Bayland Overlay Zone to preserve and enhance natural and historic resources, including wildlife and aquatic habitats, tidal marshes, seasonal marshes, lagoons, wetlands, agricultural lands and low-lying grasslands overlaying historic marshlands.
- **EN Policy 12 Bayland Area Protection.** Regulate development in the Bayland Overlay Zone so that it does not encroach into wetlands or sensitive wildlife habitats, provided that this regulation does not prevent all use of a property. Discourage human activity that damages fisheries, or habitat for birds, fish or other wildlife.
- **EN Policy 13 Views.** Encourage protection of visual access to the San Pablo Bay Shoreline and the Petaluma River.
- **EN Policy 14 Tidal Areas.** Cooperate with State and Federal agencies to ensure that areas subject to tidal action remain in their natural state.
- **EN Policy 16 Public Access and Water-oriented Uses.** Encourage public access to shoreline areas, consistent with wildlife and habitat protection and safety considerations. Allow water-oriented uses such as public access, docks and piers, and low-intensity recreational and educational activities which provide or protect wetland or wildlife habitat, and which do not require diking, filling, or dredging. Encourage restoration to tidal status, and seasonal wetlands. Allow use of shoreline areas for flood basins, and wastewater reclamation.
- **EN Policy 50 Integrated Trails System.** Facilitate the development of an integrated trails system that connects regional trails, schools, open space, parks, recreation facilities, and residential areas.

Bay Trail

ABAG developed the Bay Trail Plan (Association of Bay Area Governments 1989) as a framework for the implementation of the Bay Trail project. The Bay Trail Plan's main goal is to ensure the provision of public access to the Bay and its surrounding lands. The Bay Trail is a planned recreation corridor that will provide some 400 miles (640 kilometers) of biking and hiking trails when it is complete. A proposed segment of the Bay Trail follows Perimeter Road, located on the levee that separates the expansion site from the HAAF site, and connects

with Bel Marin Keys Boulevard. This segment would connect to an existing trail that connects with Highway 37.

In addition to the Bay Trail Plan, the Marin Countywide Plan and City of Novato General Plan also include provisions on the Bay Trail. The Marin Countywide Plan Trails Elements shows the Bay Spine Trail along the Golden Gate Bridge Highway Transit District (GGBHTD) right-of-way and the Bay Spur Trail along the bayfront levee in the HAAF area, which is consistent with the current City of Novato General Plan. The plan also shows a continuous bayfront trail from HAAF north to the existing side of Headquarters Hill (City of Novato and California State Coastal Conservancy 2001).

The City of Novato general plan includes the following program policy regarding the Bay Trail:

> Work with the Marin County Open Space District and ABAG to implement the trail system described in the Marin Countywide Plan and the Bay Trail Plan (City of Novato 1996).

The Bay Trail route as delineated in the Novato general plan shows the trail as being located along the eastern edge of Pacheco Pond. The general plan shows the trail going around the western side of Headquarters Hill near Bel Marin Keys Boulevard.

Long-Term Management Strategy and Long-Term Management Plan

In 1990, the federal EPA, Corps, BCDC, SWRCB, RWQCB, SLC, and private stakeholders established the Long-Term Management Strategy (LTMS) for material dredged from San Francisco Bay. The federal EPA, Corps, BCDC, SWRCB, and RWQCB cooperatively implement the LTMS.

The goals of the LTMS are to

- conduct dredging and the disposal of dredged material in an environmentally and economically sound manner,
- develop a permit review process, and
- maximize the beneficial reuse of dredged materials.

These goals provide the foundation for the continuing management plan. The LTMS management plan identifies 22 existing and potential locations for reuse and placement of dredged materials, 1 of which is the proposed wetland restoration site. One of the goals of the LTMS management plan is to reduce in-Bay disposal of dredged material by 1.5 million cubic yards over the next decade.

San Francisco Bay Area Wetlands Ecosystem Goals Project

The San Francisco Bay Area Wetlands Ecosystem Goals Project (Goals Project) was a 5-year volunteer collaborative effort completed in 1998. Sponsored by a group of agencies that included EPA, DFG, and RWQCB, it involved more than 100 scientists from federal, state, and local agencies, as well as private consulting firms and universities. The results of the Goals Project address a 9-county area that encompasses the entire estuary downstream of the Delta.

The Goals Project is intended to provide guidance to public and private stakeholders interested in restoring and enhancing the wetlands and related habitats of the San Francisco Bay estuary system. It is an informational document that recommends the types, areal extent, and distribution of habitats needed to sustain diverse and healthy ecosystems in the San Francisco Bay estuary. Recommendations are presented by region, subregion, and segment. Region-wide goals include the restoration of large patches of tidal marsh connected by corridors to enable the movement of small mammals and marsh-dependent birds, the restoration of large complexes of salt ponds for the management of shorebirds, and the expansion of large areas of managed marsh. The BMKV and SLC sites are identified in this plan as key areas for tidal marsh restoration.

McAteer–Petris Act, San Francisco Bay Plan, and Coastal Zone Management Act

The McAteer–Petris Act, passed by the State of California in 1965, established BCDC as the state agency responsible for regulating development in and around San Francisco Bay and directed BCDC to undertake the planning effort that resulted in the development of the San Francisco Bay Plan. The Bay Plan describes the values associated with the Bay and presents policies and planning maps to guide future uses of the Bay and its shoreline. Under the Bay Plan the priorities for suitable uses of the shoreline are ports, water-related industry, airports, wildlife refuges, and water-related recreation. The Bay Plan also proposes to add land to the Bay refuge system; encourages public access via marinas, waterfront parks, and beaches; and requires the provision of maximum access along the Bay shorelines—except where public uses conflict with other significant uses or where public use is inappropriate because of safety concerns.

The San Francisco Bay Plan was prepared to guide the future protection and use of the San Francisco Bay and its shoreline. The Bay Plan maps designate the HAAF and SLC sites for wildlife priority use and include a map note for the sites that states that the Bay Plan policy is to: "…develop comprehensive wetlands habitat plan and long-term management program for restoring and enhancing wetlands habitat in diked former tidal wetlands. Dredged materials should be used whenever feasible and environmentally acceptable to facilitate wetlands

restoration." Furthermore, the BMKV expansion site is recommended for "possible use as a wetland restoration site using dredged material."

Specific key policies from the San Francisco Bay Plan that are applicable to the proposed wetland restoration are listed below.

- To the greatest extent feasible, the Bay marshes, mudflats, and water surface area and volume should be maintained and, whenever possible, increased. Fresh water inflow into the Bay should be maintained at a level adequate to protect Bay resources and beneficial uses. Bay water pollution should be avoided (Policy 1 in Bay Plan Part III, Findings and Policies Concerning Water Quality in the Bay).
- To assure the benefits of fish, other aquatic organisms and wildlife for future generations, to the greatest extent feasible, the Bay's tidal marshes, tidal flats, and subtidal habitat should be conserved, restored, and increased (Policy 1 in the Bay Plan Part III, Findings and Policies Concerning Fish, Other Aquatic Organisms and Wildlife in the Bay).
- In reviewing or approving habitat restoration programs, BCDC should be guided by the recommendations in the Baylands Ecosystem Habitat Goals report and should, where appropriate, provide for a diversity of habitats to enhance opportunities for a variety of associated native aquatic and terrestrial plant and animal species (Policy 3 in the Bay Plan Part III, Findings and Policies Concerning Fish, Other Aquatic Organisms and Wildlife in the Bay).
- The surface area of the Bay and the total volume of water should be kept as large as possible in order to maximize active oxygen interchange, vigorous circulation, and effective tidal action. Filling and diking that reduce surface area and water volume should therefore be allowed only for purposes providing substantial public benefits and only if there is no reasonable alternative (Policy 1 in the Bay Plan Part III, Findings and Policies Concerning Bay Water Surface Area and Volume).
- Where and whenever possible, former tidal marshes and tidal flats that have been diked from the Bay should be restored to tidal action in order to replace lost historic wetlands or should be managed to provide important Bay habitat functions, such as resting, foraging, and breeding habitat for fish, other aquatic organisms, and wildlife. As recommended in the Baylands Ecosystem Habitat Goals report, around 65,000 acres of areas diked from the Bay should be restored to tidal action. Further, local government land use and tax policies should not lead to the conversion of these restorable lands to uses that would preclude or deter potential restoration. The public should make every effort to acquire these lands from willing sellers for the purpose of restoration (Policy 4 in the Bay Plan Part III, Findings and Policies Concerning Tidal Marshes and Tidal Flats Around the Bay).
- To ensure adequate capacity for necessary Bay dredging projects and to protect Bay natural resources, acceptable non-tidal disposal sites should be secured and the Deep Ocean Disposal Site should be maintained. Further, dredging projects should maximize use of dredged material as a resource

consistent with protecting and enhancing Bay natural resources, such as creating, enhancing, or restoring tidal and managed wetlands, creating and maintaining levees and dikes, providing cover and sealing material for sanitary landfills, and filling at approved construction sites (Policy 5 in the Bay Plan, Part III, Findings and Policies Concerning Dredging in the Bay).

- Public access should be integrated early in the planning and design of Bay habitat restoration projects to maximize public access opportunities and to avoid significant adverse effects on wildlife (Policy 12 in the Bay Plan, Part III, Findings and Policies Concerning Public Access to the Bay).

The federal Coastal Zone Management Act of 1972 encourages states to voluntarily develop CMPs to preserve and protect the unique features of each coastal area. BCDC is the state coastal management agency for the San Francisco Bay segment of the coastal zone, and its laws and policies constitute the federally approved state coastal management program for the Bay.

Farmland Conservation Regulations

Three major programs regulate or monitor the development and conversion of farmlands in California. These are the federal Farmland Protection Policy Act (FPPA) , the state Farmland Mapping and Monitoring Program, and the California Land Conservation Act (Williamson Act), which operates at the county level. The following summarize key aspects of each program.

Farmland Protection Policy Act

The FPPA of 1984 requires federal agencies to consider how their activities or responsibilities that involve financing or assisting construction of improvement projects, or acquiring, managing, or disposing of federal land and facilities may affect farmland. To comply with the provisions of the FPPA, the lead federal agency must consult with the NRCS and complete a land evaluation and site assessment (LESA) for each affected site or area. The federal lead agency is responsible for coordinating completion of the Farmland Conversion Impact Rating Form (Form AD-1006) with the NRCS.

Under the LESA system, proposed project sites receive scores based on several criteria, including soil quality and existing land use. The highest possible score for a site is 260 points. If a proposed federal action would affect a site that has been rated with a score ≥160, alternative sites should be considered.

Farmland Mapping and Monitoring Program

As part of its Farmland Mapping and Monitoring Program, the California Department of Conservation (DOC) periodically prepares maps of important farmlands for most of the state's agricultural areas. Preparation of these maps follows DOC's Important Farmland Inventory (IFI) system, which relies on the following sources of information.

- NRCS (formerly SCS) soil survey maps

- Land inventory and monitoring criteria developed by NRCS to characterize the land's suitability for agricultural production, the physical and chemical characteristics of its soil, and the actual (existing) land use
- Land use information mapped by the California Department of Water Resources (DWR)
- Important farmland maps, typically updated every 2 years

The important farmland mapping system defines 4 categories of farmlands and 3 categories of lands used for non-agricultural purposes. Following are the 4 farmland mapping categories.

Prime Farmland – Lands with a combination of physical and chemical features best able to sustain long-term production of agricultural crops. The land must be supported by a developed supply of irrigation water that is dependable and of adequate quality during the growing season. It must also have been used for the production of irrigated crops at some time during the 4 years before mapping data were collected.

Farmland of Statewide Importance – Lands with agricultural land use characteristics, irrigation water supplies, and physical characteristics similar to those of prime farmland but with minor shortcomings, such as steeper slopes or soils that retain less moisture.

Unique Farmland – Lands with soils of lower quality used for the production of California's leading agricultural cash crops. Unique farmlands are typically irrigated but include non-irrigated orchards or vineyards in some of the state's climatic zones.

Farmland of Local Importance – Lands of importance to the local agricultural economy, as determined by each county's board of supervisors and a local advisory committee.

California Land Conservation Act (Williamson Act)

The California Land Conservation Act (Williamson Act) is one of the state's primary mechanisms for conserving farmland. This voluntary program is administered at the county level and offers landowners property tax incentives to maintain their lands in agriculture or other compatible uses. Under the Williamson Act, private landowners may enter into a contract with their county, limiting the use of their land to agriculture or other compatible use for a minimum period of 10 years. In return, the county assesses the land at its agricultural value rather than its fair market value. This limits property tax increases that could otherwise arise from land speculation.

Land Uses, Zoning, Easement, Utilities, and Farmland Designations in the Expansion Area

Land Use and Zoning

The BMKV site consists of former baylands that were diked for agricultural use in the late 19th century. Recently, the majority of the site has been under cultivation for oat hay. Two fields were authorized in the1980s for the placement of dredged materials and have subsequently been left fallow (figure 4-11).

The BMKV site is located within the City-Centered Corridor planning area of Marin County and is designated for agriculture and conservation use, with a permitted residential use of 1 unit per 2–10 acres (RSP 0.5).

The BMKV site is zoned within the Bayfront Conservation (BFC) Zone. This zone is intended to preserve, protect, and enhance existing species and habitat diversity in the county.

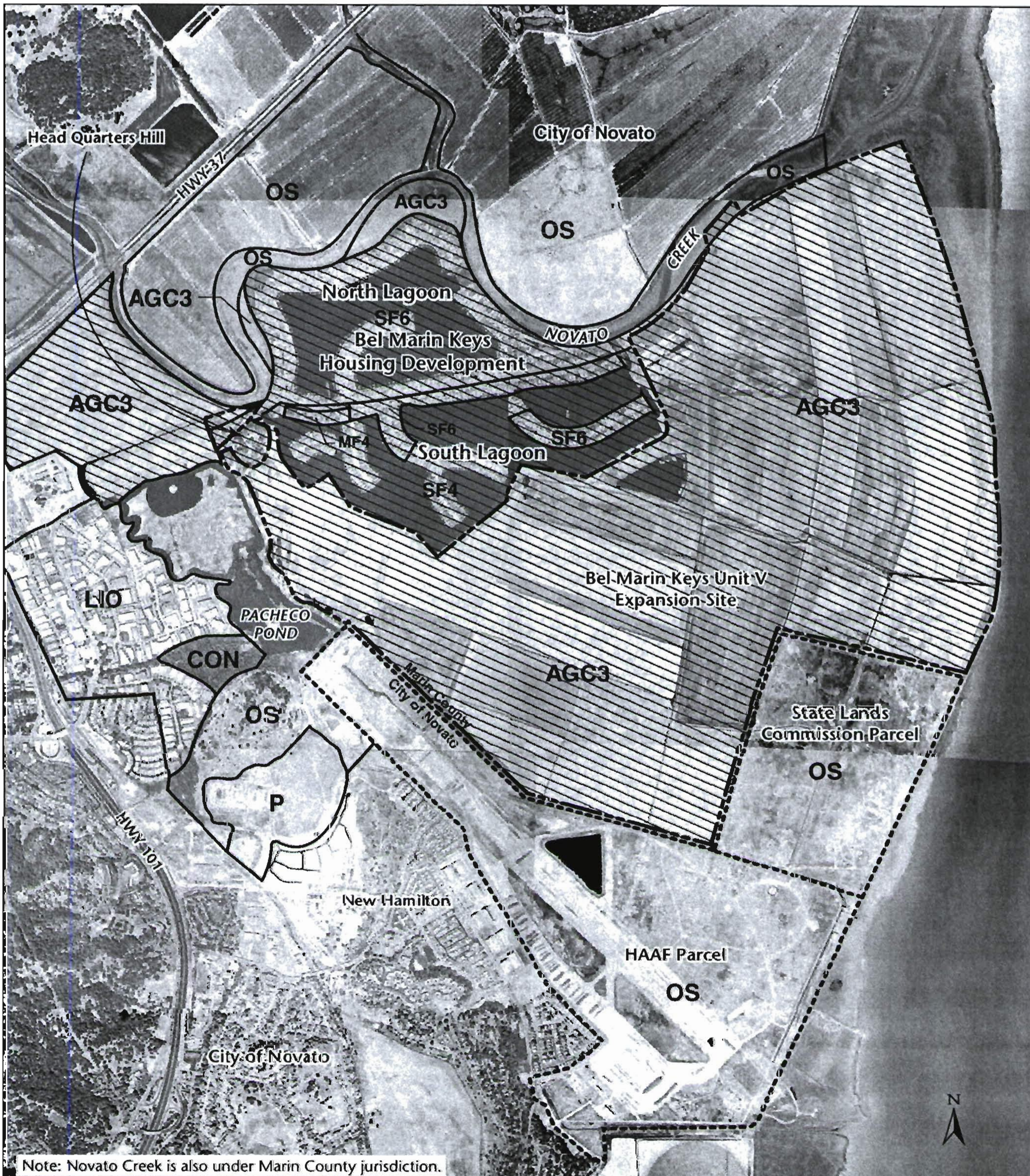
The majority of the proposed wetland restoration site is zoned BFC–RSP 0.5 (Bayfront Conservation – Residential, Single-Family Planned 1 unit/2acres) and the remainder is zoned BFC–ARP 2 (Bayfront Conservation – Agricultural, Residential, Planned 1 unit/ 2 acres) (figure 4-12). Existing land use designations and zoning support agricultural and open space uses and restoration of agricultural land to wildlife habitat and/or wetlands. Planned single-family residential development with a density of 0.5 unit per acre is also permitted. However, in part because of the need to balance the requirements of the natural and built environments within the BFC Zone, the county does not guarantee approval of the maximum housing density permitted by existing zoning; actual approvals would be contingent on the results of environmental compliance documentation for proposed development projects (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

Flood zoning is discussed separately above in the *Surface-Water Hydrology and Tidal Hydraulics* section.

Easements

Two utility easements cross the BMKV site. A 20-foot easement for the NSD outfall pipeline is located on the east side of the levee that separates the expansion site from the HAAF site. An easement for the PG&E transmission line and towers crosses the northern portion of the BMKV site, west and east of the BMK south lagoon.

BMK CSD has a number of easements on Conservancy-owned land. The Conservancy owns some of the land under the BMK south lagoon, including the land under the lock, and BMK CSD has easements for the drainage, navigation,



Land Use Key

LIO	Light industry/office	OS	Open space	AGC3	Agriculture/conservation		BMKV Expansion
MF4	Multi-family	SF4	Single-family (1-2 units/acre)		Marin County jurisdiction		Hamilton Wetland Restoration Project
CON	Conservation	SF6	Single-family (4-7 units/acre)	P	Parkland		

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Figure 4-11
Current and Adjacent Land Uses at the Bel Marin Keys Unit V Expansion Site

Zoning Key

PD-B	Planned district bayfront	BFC	Bayfront conservation	— — —	BMKV Expansion
RSP.5	Residential single family planned (1 unit/2 acres)		Marin County jurisdiction	- - - - - -	Hamilton Wetland Restoration Project

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Figure 4-12
Current and Adjacent Zoning at the Bel Marin Keys Unit V Expansion Site

and maintenance associated with the lagoon proper. The restoration project includes no actions on the lands under the south lagoon itself, so these easements would not be affected.

BMK CSD also has an easement for maintenance of the south lagoon levee. This 100-foot easement allows access for the maintenance of the south lagoon.

Several drainage agreements held by MCFCWCD and one drainage agreements held by BMK CSD are discussed separately in the *Surface-Water Hydrology and Tidal Hydraulics* section.

Utilities

The utilities on the proposed wetland restoration site include 5 PG&E electric transmission line towers and the NSD sewer line. The 5 electric transmission line towers are located in the north-western and north-central portion of the expansion site, adjacent to Novato Creek and are located within a 40-foot wide easement. The NSD line is located on the BMKV side of the levee that separates the expansion site from the HAAF site.

Farmland Designations

The BMKV site received a score of 53 under the LESA system, well below the 160 LESA score at which alternative sites should be considered, because the site is poorly drained, has low fertility, and lacks a supply of irrigation water (San Francisco International Airport 2001). The BMKV site has been identified as farmland of local importance. The BMKV site is not currently under Williamson Act contracts.

Land Uses Adjacent to the Expansion Site

Bel Marin Keys Residential Community

The marina residential area of BMK is located north of the expansion site and includes approximately 700 single-family homes located along 2 managed lagoons connected to Novato Creek by 2 locks (figure 4-11). The lagoons provide opportunities for recreational water sports and berthing for private watercraft. The south lagoon is contained by a levee located on property now owned by the Conservancy. Part of the south lagoon channel and the lock structure is also on lands owned by the Conservancy. The BMK CSD possesses easements for maintenance of the lagoon levee and for navigation purposes across the Conservancy-owned portions of the channel and lock. BMK boat owners use Novato Creek to access the Bay. The south lagoon levee is used informally by BMK residents and occasionally by other members of the public

for walking and dog walking. The levee is not a designated trail. The BMK CSD easements for levee maintenance do not provide an entitlement for recreational access or use of the south lagoon levee.

Headquarters Hill

Several private homes are located on Headquarters Hill adjacent to the northwest corner of the expansion site and adjacent to Bel Marin Keys Boulevard (figure 4-11). Headquarters Hill is not owned by the Conservancy and is not part of the proposed expansion.

Pacheco Pond

Pacheco Pond is located west of the proposed expansion site. This 120-acre site is a flood control reservoir that was constructed by the developer of the Ignacio Business Park and was deeded to MCFCWCD as a detention basin for flows from Pacheco Creek and Arroyo San Jose. Water from Pacheco Pond is currently discharged to Novato Creek. The Ignacio Business Park, which is a mixed-use office/light industrial/commercial development, is located west of Pacheco Pond (figure 4-11).

Novato Creek

Novato Creek is used for navigation by boats that are docked in the Bel Marin Keys south and north lagoons and can be used for recreation by boats that may access the creek from San Pablo Bay. Novato Creek is designated as a navigable water and a public way, from its mouth to Sweetzer's Landing, by the California Harbors and Navigation Code Section 104.

The form of the Novato Creek channel has been significantly altered by development in the lower watershed. Prior to agricultural development, the daily flow of tides in approximately 3,500 acres of wetland in the lower watershed maintained a much larger channel than currently exists. Since agricultural development, the creek has been cut off from wetlands that provided a large part of its tidal prism. Scouring flows have been reduced to approximately 3% of the historical tidal flow rate, which has caused the channel to contract in depth and associated cross-sectional area. To mitigate the effects of reduced channel depth on navigation and flooding dynamics, sections of the lower reaches of Novato Creek have been dredged. From the mid 1960s to the late 1980s, navigation dredging by BMK CSD occurred on an approximately 10-year cycle. Within the lower tidal reaches of Novato Creek (i.e., BMK region and downstream), tidal conveyance represents the primary sediment source, delivering sediment to the creek by flood tides that contain suspended sediment from San Pablo Bay. Sedimentation rates and patterns in this reach are consistent with other tidally influenced channels in the North Bay (Philip Williams and Associates 2002).

Hamilton Army Air Field

The former HAAF is located south of the proposed expansion site. HAAF was decommissioned as an active Air Force facility in 1974. The parcel includes a former runway, aprons, taxiways, a revetment area, an airplane hangar, and other miscellaneous structures. The revetment area is located in the northeastern corner of the revetment turnouts. The HWRP is currently being planned for this site, in which tidal marsh and seasonal marsh will be restored (figure 4-11). The adjacent Bulge parcel, currently owned by the City of Novato, is zoned for open space and currently unutilized.

State Lands Commission Parcel

Land Use

The area that now makes up the SLC parcel was owned by the Air Force and was operated as part of HAAF until 1974. While the base was active, the parcel supported a variety of uses, including a rifle range, a pistol range, and antenna facilities. It was also used at various times for skeet shooting and firefighter training. Some infrastructure related to military uses remains onsite. When HAAF was decommissioned, the State of California acquired the parcel and leased a portion of the rifle range to the City of Novato for police small arms training (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998). Antennas and associated cables are also located in the area. Other facilities at the site include aboveground fuel tanks, transformers, target-practice ranges previously used by the Novato Police Department, and burn pits.

The City of Novato General Plan designates the SLC parcel as open space. It describes open space uses as "publicly-owned land that is largely unimproved and devoted to the preservation of natural resources, outdoor recreation, floodways and flood control, and the maintenance of public health and safety." The allowable uses within this land use category include uses devoted to the preservation of natural resources.

The SLC parcel is also located within an area zoned by the general plan as the Bayfront Area. The designated Bayfront Area was established to "preserve and enhance natural and historic resources, including wildlife and aquatic habitats, tidal marshes, seasonal marshes, lagoons, wetlands, agricultural lands, and low-lying grasslands overlaying historic marshlands."

Utilities

NSD has two 50-year easements on the SLC parcel: a 20-foot-wide easement for the outfall pipeline; and an easement for the dechlorination plant, which is located on the southern edge of the SLC parcel. Treated effluent is conveyed from the Ignacio Treatment Plant and the Novato Treatment Plant to the dechlorination plant through a 54-inch outfall force main located on the BMKV and SCL parcels, parallel to the HAAF perimeter levee. The treated effluent is dechlorinated and then discharged to San Pablo Bay. Power is supplied to the

dechlorination plant through an underground power line that runs from a transformer at the perimeter ditch pump station along the outboard side of the HAAF levee. Water is brought to the dechlorination plant in trucks and is stored onsite. The HWRP would relocate the dechlorination plant to allow the wetland restoration effort to proceed on the SLC parcel.

Environmental Consequences and Mitigation Measures

Approach and Methods

Information related to land uses, utilities, and easements at the expansion site was reviewed and compared to the restoration alternatives to evaluate the potential for land use conflicts, disruption or loss of services provided by utilities, or conflicts with easements. Potential impacts were compared to the thresholds of significance described below to determine the level of significance of each impact.

Impact Mechanisms

The following impact mechanisms would affect the land use of the expansion site.

- Placing dredged material to create elevations suitable for tidal marsh restoration
- Creating public access along the Bay Trail or spurs to the Bay Trail
- Breaching the perimeter levee of the site to restore tidal connection to the site with San Pablo Bay and Novato Creek

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding land use and utilities, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- conflict or be incompatible with the land use goals, objectives, or guidelines of applicable general plans;
- be inconsistent or conflict with statutes of the California Coastal Act or the land use goals, objectives, or policies of BCDC or other applicable state agencies;
- substantially conflict with an existing onsite land use;

- substantially conflict with existing or future adjacent land uses;
- result in the loss of an existing easement or service to existing facilities;
- conflict with existing regional utility infrastructure; and
- convert a large amount of prime farmland, unique farmland, or farmland of statewide importance to a non-compatible and/or non-agricultural use.

In general, permitted and adopted land uses in areas surrounding the expansion area are compatible with habitat restoration. Consequently, implementation of the habitat restoration is not generally expected to result in adverse effects on existing or planned land uses adjacent to the proposed wetland restoration site. However, habitat restoration would result in the impacts on land use described below.

Impacts and Mitigation Measures of No-Action Alternative

The No-Action Alternative would not result in any impacts to land uses on the expansion site. The proposed wetland restoration site would continue to support agricultural fields and utilities. The site would also continue to provide capacity for floodwater overflows from Novato Creek and Pacheco Pond.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact LU-1: Consistency with Applicable City and County General Plans and Policies

The proposed wetland restoration is generally consistent with applicable county policies that support the enhancement of the wildlife and aquatic habitat value of the diked historic marshlands in the BFC Zone along San Pablo Bay. (A specific land use policy consistency analysis for all policies described above in the *Environmental Setting* is provided in appendix J. This impact analysis focuses on the primary city, county, and other jurisdiction policies that would be affected by implementation of the proposed wetland restoration.)

County Policy EQ-2.42 encourages the County to preserve and enhance the diversity of wildlife and aquatic habitats found in bayfront lands. The proposed wetland restoration would result in tidal wetland, other tidal habitats, seasonal wetland, and upland habitat. Additionally, the project would preserve and enhance the diversity of wildlife and aquatic habitats.

Policy EQ-2.45 encourages land uses that provide or protect wetland or wildlife habitat, including restoration to tidal status and to seasonal wetlands, and

preserves non-native agricultural lands. However, the MCP does not weight or give preference to any of these uses. It is not intended that each of these uses must be a part of any restoration plan, but rather that these uses are acceptable and compatible with the intent of the BFC Zone designation.

Some of the MCP policies (e.g. EQ-2.45) contain language discouraging any filling within the BFC Zone, however the language referring to potential filling is primarily in the context of fill for development, not for habitat enhancement. Alternative 1 and Revised Alternative 2 would require the placement of dredged material and all 3 alternatives would include construction of levees on the BMKV site. While these activities might be considered "fill," these activities are only proposed in the overall purpose of enhancing the wildlife and aquatic habitat value of the BMKV site and implementing the overall site design. Mitigation measures described above in the *Biological Resources* section are proposed to reduce adverse impacts resulting from such activities on existing habitat and the project overall would increase substantially the amount of wetland habitat at the site.

Implementation of any of restoration alternatives at the BMKV parcel would result in conversion of the existing agricultural lands, which would be inconsistent with MCP Policy EQ-2.58 and A-1.6. MCP Policy EQ-2.58 recognizes agricultural lands as important as a visual resource, as part of agricultural and dairy operations, as a productive economic resource, and as compatible with, and in some cases, providing wildlife habitat. The purpose of MCP Policy A-1.6 is to minimize impacts to agricultural lands by preventing or mitigating for the loss of productive agricultural land within the BFC Zone. As discussed below in the *Visual Aesthetics* section of this chapter, the restoration of tidal wetlands and other habitats on the site is expected to maintain or improve the visual aesthetics of the BMKV site itself (although some alternatives would result in partial obstruction of certain existing views). As described below under impact LU-5, the agricultural land at the BMKV parcel is not designated prime farmland, unique farmland, or farmland of statewide importance, is a small portion of available Marin County agricultural land, and has not produced substantial crops to support the local agriculture economy. While agricultural land can be compatible with wildlife habitat, the restoration alternatives would provide a significant enhancement of the wetland and aquatic habitat of the site compared to the existing setting.

While the project would be inconsistent with EQ-2.58 and A-1.6 taken in isolation, the project is considered overall to be consistent with the intent of the County policies for the BFC Zone. The possibility of returning undeveloped former marshes to more productive wildlife habitat by restoration is recognized as a potential purpose of the diked bay marshland and agricultural subzone in the MCP. Given the emphasis within County policies regarding enhancement of the wildlife and aquatic habitat of diked historic marshlands, the restoration of the site to habitats of higher quality and greater importance to the Novato Creek and San Pablo Bay ecosystems than those present today would be a higher priority

use of the site than retaining the site in its current low-productivity agricultural setting.

City of Novato policies would apply to portions of the Bay Trail located on City or MCFCWCD land west of the HWRP and BMKV. The project in general is consistent with the overall intent of city policies related to shoreline uses. Discussion of the Bay Trail relative to land use is provided below under Impact LU-2. Discussion of the Bay Trail relative to biology is provided in the *Biological Resources* section of this chapter.

Overall the project is considered consistent with the intent of Marin County and City of Novato general plan policies for the bayfront lands and the potential inconsistencies noted above regarding fill and agriculture are considered less than significant impacts.

Discussion of flood zoning is presented above in the *Surface Water Hydrology and Tidal Hydraulics* section.

Impact LU-2: Compatibility with Designated Bay Trail Routes and Effects on Existing Informal Recreational Use

As described previously in chapter 3, the proposed wetland restoration includes extending the Bay Trail south from the City levee along the HWRP perimeter levee, north from the City levee to Pacheco Pond, and then north to Bel Marin Keys Boulevard. Each alternative also includes construction of an interpretive center.

The unique portions of the Bay Trail routes and location of an interpretive center for each restoration alternative are described below.

Under Alternative 1, the Bay Trail would be located along the western edge of Pacheco Pond and connect to Bel Marin Keys Boulevard. The interpretive center would be located south of the HWRP seasonal wetland area. Under Spur Option 1A, a spur to the Bay Trail would extend from the west side of Pacheco Pond to Novato Creek along existing and new levees constructed for the wetland restoration.

Under Revised Alternative 2, the Bay Trail would be located along the eastern edge of Pacheco Pond along the existing levee and connect to Bel Marin Keys Boulevard around the western boundary of Headquarter Hill. The interpretive center would be located west of the HAAF site on City of Novato property. There would be no spur along existing or new levees from Pacheco Pond to Novato Creek under Revised Alternative 2.

Under Alternative 3, the Bay Trail would be located along the eastern edge of the expanded Pacheco Pond on the new levee and cross the BMKV site to Bel Marin Keys Boulevard. The interpretive center would be located on the BMKV site.

Under Spur Option 3A, a spur to the Bay Trail would extend from the east side of Pacheco Pond to Novato Creek along a new levee constructed immediately south of the BMK south lagoon levee.

In general, the purpose of the Bay Trail Plan is to provide north–south access to facilitate and create recreational opportunities associated with the Bay. Alternatives 1–3, including both their common elements and their unique routes to Bel Marin Keys Boulevard, are generally consistent with this purpose. However, the Bay Trail proposed under Alternative 1 would not be consistent with the preferred connector route, according to the existing Bay Trail Plan (along the eastern edge of Pacheco Pond) or the City of Novato Plan because it would require locating the Bay Trail along the western edge of Pacheco Pond. Since the dominant interest concerning the Bay Trail is establishing a north–south connection, the Alternative 1 routing is considered generally consistent with existing plans, and the impact is considered less than significant. Revised Alternative 2 is consistent with the current Bay Trail route proposed by the City and County. Alternative 3 is generally consistent with the current proposed Bay Trail route, although the last portion of the Bay Trail under this alternative goes around the east side of Headquarters Hill, whereas the designated route goes around the west side of Headquarters Hill.

Spur Options 1A and 3A are not envisioned in current planning for the Bay Trail. However, construction of such spurs would not hinder the completion of a north–south connector from HAAF to Bel Marin Keys Boulevard. Although not called for in current Bay Trail planning, the spur options are not considered inconsistent with existing plans. The spur options would place a public trail in proximity to the BMK south lagoon, where no designated public trail currently exists. As noted above, there is informal use at present of the south lagoon levee for walking.

A number of community members in the BMK residential area raised concerns about the proximity of the proposed spur trail under Alternatives 1 and 3 in regards to noise, aesthetics, and security. Noise from foot traffic is not considered a significant incompatibility with nearby residential use. Aesthetics regarding the levee itself are discussed in the *Aesthetics* section below, but the presence of additional pedestrians where there is already informal use by walkers is not considered a significant effect. Regarding security, the BMK community is accessible by public road at present. Any trail along the south lagoon levee or along the new levee would not provide a new path of access into the community because the lagoon itself separates the trail from the residences; therefore, this is not considered a significant effect.Under Alternative 1, the trail would be located approximately 1,000 feet south of the BMK south lagoon levee. Given the distance from the BMK south lagoon, foot traffic along the trail spur is not expected to result in a significant incompatibility with the BMK residential area. The aesthetics of new levee construction in Alternative 1 are discussed separately below in the *Aesthetics* section.

Under Alternative 3, the spur trail would be located on the new levee, approximately 50 feet south of the BMK south lagoon levee. In some areas, the trail would be approximately 150 to 200 feet from several houses in the eastern part of BMK residential areas, located at the southern end of streets facing south toward the south lagoon levee. This would result in additional noise from foot traffic in this area and visibility, compared to Alternative 1. However, use of the spur trail is expected to be infrequent and limited to foot traffic and would be similar to the informal use at present, so noise or visual disruption from trail use is not expected to result in significant disruption of adjacent residential uses. Visual aesthetics of construction of the new levee itself under Alternative 3 are discussed separately below in the *Aesthetics* section.

Regarding the informal use of the south lagoon levee for walking, Alternative 1 and Revised Alternative 2 would displace this use, while Alternative 3 would convert this informal use into a publicly designated trail. Under Alternative 1, the informal use would be displaced to a public trail along the new levee. Under Revised Alternative 2, the informal use would be displaced to the Bay Trail, but there would be no public access eastward to Novato Creek. Under Alternative 3, the new designated trail would be just south of the existing levee. Under all 3 alternatives, with the implementation of recommended mitigation for management of access effects on wildlife, no dogs would be allowed on the BMKV site. The displacement of the existing informal use of the south lagoon levee for walking is considered a less-than-significant land use impact because the existing informal use is not on a publicly designated trail, the restoration alternatives all provide for alternative public access trails that would connect with regional trail systems, and access to the new trail(s) would be in proximity to the BMK community. Prohibition of dogs is considered necessary for habitat protection on the BMKV site but is not considered a significant land use impact because of the informal nature of the current dog walking use, the level of existing activity, and the existence of other designated public trail areas or other areas in the vicinity to walk dogs.

Impact LU-3: Conflict with Existing Utilities and Utility Easements

There are 5 electric transmission line towers and an NSD sewer line that are located on the expansion site. The construction of the proposed BMKV expansion has the potential to result in damage to the existing regional utilities infrastructure, through the disruption of service from the electric transmission lines and restricting access for maintenance activities. Prior to construction, concrete casings would be installed on the footings of the electric transmission line towers to prevent damage to the structures. Raised boardwalks would also provide maintenance access to the electric transmission line towers from the proposed flood protection levee and the existing Novato Creek levee. Service would not be interrupted as a result of implementation of the proposed BMKV expansion, and therefore there would be no impact on the electric transmission line service.

Under all 3 alternatives, the new NSD sewer line would be installed adjacent to the current alignment, except around Pacheco Pond. Under all 3 alternatives, a new section of pipeline would be installed around the eastern side of the expanded Pacheco Pond; under Revised Alternative 2, the expanded pond would be about half the size it would be under the other 2 alternatives. Access would continue to be provided by the berm that separates the expansion site from the HAAF site. Service would not be interrupted as a result of implementation of the proposed BMKV expansion under any of the alternatives, and therefore there would be no impact on existing utility service.

Under all 3 alternatives, the proposed berm access trail between BMKV and HAAF on the NSD line would be constructed at an elevation of 4 to 6 feet. If the berm were constructed at 4 feet, the NSD line could not be accessed during all weather conditions, as tidal overflow would cover the berm. If the berm were constructed at 6 feet, all weather access would be possible, as tidal overflow at this elevation is rare. This impact is considered less than significant.

Impact LU-4: Conflict with Other Existing Easements

In addition to the PG&E and NSD easements, the BMKV site is also subject to the requirements of several drainage agreements with MCFCWCD and with BMK CSD, as well as a maintenance agreement with BMK CSD for the BMK south lagoon. The drainage agreements are discussed separately above in the *Surface Water Hydrology and Tidal Hydraulics* section.

The easement for the maintenance of the south lagoon levee allows BMK CSD access to the levee for maintenance. Under all alternatives, the BMK south lagoon would be improved, which would result in the levee being increased to a top height of approximately 6 feet NGVD. The current south lagoon levee ranges in height from 2 to 5 feet NGVD. In addition to improving the south lagoon levee, new water conveyance structures (Alternative 1 and Revised Alternative 2) or pumps (Alternative 3) would be installed to facilitate flow from the south lagoon to either a swale area or the tidal marsh restoration area. Access would be provided under any alternative for maintenance of the lagoon or water management structures.

The restoration alternatives are not expected to compromise the intent of the existing easements related to the maintenance of the south lagoon levee or overflow structure.

Impact LU-5: Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to Non-Agricultural Use

No prime farmland, unique farmland, or farmland of statewide importance would be affected by habitat restoration on the BMKV site. The site currently supports

farmland of local importance. The total amount of land converted (1,241 acres) would be small relative to the total area of land designated for agricultural use in Marin County (167,000 acres) (San Francisco International Airport 2001). Additionally, much of the site has remained fallow for many years, and therefore the site has not produced substantial crops to support the local agriculture economy. Consistency with Marin countywide policies regarding agriculture is discussed above under Impact LU-1.

During the 1997 appraisal of the property by the Conservancy, the agricultural potential of the expansion site was assessed and was not considered economically sustainable because of poor drainage, low fertility, and lack of an irrigation supply. Further, the Conservancy has also consulted with an agricultural advisor at the Southern Sonoma-Marin Resource Conservation District (RCD) who stated that the land was very poor quality for farming because of a number of factors, including poor soil quality, poor drainage, and lack of water supply (Gustasson pers. comm.).

The loss of agriculture at the expansion site is a less-than-significant impact because the site is not prime farmland, unique farmland, or farmland of statewide importance; agriculture is not considered economically sustainable onsite due to the low quality of soils, poor drainage, and lack of irrigation water; and the site plays a relatively limited role in the County and regional agricultural economy. Further, because the project promotes habitat restoration and enhancement within an area in the BFC Zone, the public values for which agriculture onsite was previously considered valuable (namely open space, views, and habitat) are preserved and/or enhanced by the proposed wetland restoration.

Impacts and Mitigation Measures Unique to Alternative 1 and Revised Alternative 2

Impact LU-6: Modifications to Morphology of Novato Creek due to Breach of BMKV/Novato Creek Levee May Affect Navigation

The conceptual design plans for Alternative 1 and Revised Alternative 2 include a marsh basin connection to Novato Creek through a single levee breach. The breach would be located at the downstream end of the creek, only a few thousand feet from San Pablo Bay. Preliminary analysis of local scour from increased tidal prism reveals a minor widening of the creek channel, between 10 and 40 feet, and a minor deepening of the channel, approximately 0.5 to 1.0 feet, along the approximately 4,000-foot portion of Novato Creek, downstream of the breach to the mouth. The increase in tidal prism is also expected to cause additional widening and a minor deepening of the subtidal channel of Novato Creek, beyond the mouth. The locations of these morphological changes are shown in

figure 4-7 in the *Surface-Water Hydrology and Tidal Hydraulics* section, which also discusses morphological effects in greater detail.

These changes in morphology of the lower portion of Novato Creek are expected to occur directly adjacent to the existing main channel of Novato Creek, from the breach to the mouth, and the subtidal channel, beyond the mouth. Because the effect of adding tidal prism to this portion of the creek is a minor increase in channel width and depth, these changes in morphology are not expected to have a significant adverse effect on the navigability of Novato Creek. Since this portion of Novato Creek presently requires maintenance dredging to provide adequate channel size for boat passage, the addition of tidal prism is an incidental beneficial effect of the project on navigability, although the authorized purpose of this project is not navigation. It should be noted, however, that the potential addition by the project of 400 to 600 acres of tidal prism to this portion of Novato Creek is not expected to result in sufficient channel width or depth to eliminate the need for future maintenance dredging.

Impacts and Mitigation Measures Unique to Alternative 3

Impact LU-7: Inconsistency with the Long-Term Management Strategy Management Plan

The BMKV site is one of the 22 existing and potential locations identified by the LTMS Management Plan as possible reuse and upland placement areas for materials dredged from San Francisco Bay. Because Alternative 3 relies on natural sedimentation to establish suitable elevations for tidal marsh restoration, this alternative would not assist in the implementation of the LTMS Management Plan. The BMKV site contains approximately 13 million cubic yards of capacity for dredged material reuse in wetland creation and, along with the Montezuma and Skaggs Island sites, it is one of the largest potential reuse sites identified in the LTMS management plan. The infrastructure for dredged material off-loading is under construction at the HAAF site, adjacent to BMKV.

This impact is considered adverse because it may hinder the availability of suitable reuse sites, thus potentially slowing the LTMS goal of decreasing in-Bay disposal of dredged material over the next decade. No mitigation, short of changing to an alternative that uses dredged material, is available to mitigate this impact.

Whether this is an adverse impact depends on whether there are sufficient approved reuse and upland placement sites available to accommodate reasonably foreseeable maintenance dredging operations in San Francisco Bay, so as to implement the reduction in Bay disposal volumes as envisioned in the LTMS Management Plan. This determination is outside the scope of this study.

Hazardous Substances and Waste

Affected Environment

Data Sources

The information presented in this section is based on existing data and previous reports that apply to the proposed BMKV expansion site and the SLC site. Descriptions of hazardous materials investigations and cleanup refer to areas of concern within the BMKV and SLC parcels, as well as a small portion of a City of Novato property known as the "Bulge" parcel. Overview of current remedial status at the neighboring HAAF parcel is also briefly discussed for information purposes. Possible sources of introduced hazardous substances from fill materials are also described.

The primary sources of information used for this section include the following.

- *Hamilton Wetland Restoration Plan Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS)* (Jones & Stokes 1998), and its sources
- *Bel Marin Keys Unit V Final EIR/EIS* (Environmental Science Associates 1993)
- *Phase I Environmental Assessment Bel Marin Keys Unit V* (Miller Pacific Engineering Group 1994)
- *Results of Shallow Soil Investigations, Bel Marin Keys Unit V Property* (Erler & Kalinowski, Inc. 2002)
- *Phase II Site Investigation Report North Antenna Field Hamilton Army Airfield* (IT Corporation 2000)
- *Draft Remedial Investigation Report, North Antenna Field, Hamilton Army, Airfield, Novato, CA* (Shaw Environmental & Infrastructure, Inc. 2001)
- *Comprehensive Remedial Investigation Report, BRAC Property, Hamilton Army Airfield, Novato, California* (IT Corporation 1999a)
- *Baseline Human Health and Ecological Risk Assessment for the Base Realignment and Closure Act (BRAC) Property at Hamilton Army Airfield (HAAF), Novato, California* (IT Corporation 2001)
- *Final Report: Inboard Area Focused Feasibility Study Report: BRAC Property Hamilton Army Airfield* (CH2M Hill 2001)
- *Archives Search Report Conclusions and Recommendations, Hamilton Army Airfield, Marin County, California* (U.S. Army Corps of Engineers, St. Louis District, 2001)

- *Statement of Condition, Ammo Hill and 800-B Parcels, Phase II GSA Sale Property, Hamilton Army Airfield, Novato, California* (U.S. Army Corps of Engineers, Sacramento District 1999)
- *Preliminary Assessment Report for GSA Phase II Sale Area, Hamilton Army Airfield, October 1996* (IT 1996)
- *Final Remedial Action Plan, 800-B and Ammo Hill Parcel, GSA Phase II Sale Area, Hamilton Army Airfield, Novato California* (IT 1998)
- Sediment Testing Data (Advanced Biological Testing 1997, 2000)

In addition, the primary sources of information regarding the potential introduction of hazardous substances from dredged materials include the following.

- *Draft Bel Marin Keys Conceptual Restoration Design Technical Report* (Jones & Stokes 2002)
- *Draft Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region Policy EIS/Programmatic EIR* (U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, San Francisco Bay Conservation and Development Commission, San Francisco Bay Regional Water Quality Control Board, and California State Water Resources Control Board 1996)
- *Oakland Harbor Navigation Improvement (50-Foot) Project Draft Feasibility Study and EIR/EIS* (U.S. Army Corps of Engineers and Port of Oakland 1998a, 1998b, 1998c, 1998d, and 1998e)

Regulatory Overview

Several federal and state agencies have regulations that govern the use, generation, transport, and disposal of hazardous substances. The principal federal regulatory agency is the federal EPA. The primary California state agency with similar authority and responsibility is the California EPA (Cal-EPA), which may delegate enforcement authority to other local agencies that have agreements with Cal-EPA. Hazardous materials and hazardous waste are regulated by the Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); CCR Title 26; and other relevant state and federal regulations. Federal regulations applicable to hazardous substances are contained primarily in Titles 29, 40, and 49 of the CFR. State regulations have been consolidated in Title 26 of the CCR.

Bel Marin Keys Unit V Expansion Site

Cal-EPA/Department of Toxic Substances Control (DTSC) is the lead agency for regulatory enforcement and oversight of any potential cleanup activities at the BMKV site. The Conservancy, as the owner of the BMKV site, is the responsible party for implementing any assessment and required remedial activities at the BMKV site.

State Lands Commission Parcel

The SLC parcel is currently being remediated under the FUDS program. (In FUDS remedial documents, the SLC parcel is usually referred to as the North Antennae Field [NAF] site. In this document, the parcel is referred to as the SLC parcel because the State Lands Commission owns it.) FUDS is an element of the Defense Environmental Restoration Program (DERP) (10 USC 2701 et seq.). It requires remediation of contaminated sites consistent with CERCLA, with the objective of finding a timely, cost-effective way to reduce the risk to human health, safety, and the environment resulting from past activities of the Department of Defense. In regards to remedial activities, the SLC parcel is the responsibility of the Department of Defense under the FUDS process with the Corps as the administering agency.

All contaminants on the SLC parcel would be remediated to support reuse before ownership of the site is transferred (California State Coastal Conservancy and U.S. Army Corps of Engineers 1998).

The BMKV expansion makes no determinations whatsoever regarding potential remedial activities at the SLC parcel. The lead agencies of the BMKV expansion presume that the FUDS process will result in implementation of remedial approaches that provide cleanup of any contaminated sites on the SLC parcel to a condition suitable for the proposed wetland use. If the remedial determinations ultimately made through FUDS require changes in the wetland designs proposed for the SLC parcel, then the lead agencies will evaluate the potential effects of the changes and determine whether additional NEPA/CEQA compliance will be necessary for the affected portions of the HWRP. The lead agencies' presumption that the FUDS process will result in remedial activity that leaves the site suitable for the proposed wetland use is the basis for analysis in this document.

Hamilton Army Airfield Parcel

Remedial issues at the HAAF parcel (including the Navy Ballfields) are being addressed through the BRAC process. As stated above, remedial issues at the SLC parcel are being address through the FUDS remedial process. These processes were described in chapter 2. The BMKV expansion makes no determinations whatsoever regarding potential remedial activities at the HAAF parcel. The BMKV expansion also makes no changes in the wetland design on

the HAAF parcel, which was analyzed in the 1998 EIS/EIR for the HWRP. The lead agencies of the BMKV expansion presume that the BRAC process will result in implementation of remedial approaches that provide cleanup of any contaminated sites on the HAAF parcel to a suitable condition for the proposed wetlands reuse. If the remedial determinations ultimately made through BRAC require changes in the wetland designs proposed for the HAAF parcel, then the lead agencies will evaluate the potential effects of the changes and determine whether additional NEPA/CEQA compliance will be necessary for the affected portions of the HWRP. The U.S. Army is the implementing agency for the BRAC process at HAAF. The U.S. Navy is the implementing agency for the BRAC process at the Navy Ballfields site.

City of Novato Bulge Parcel

The BMKV expansion Alternative 1 and Revised Alternative 2 include an interpretive center and an access area on the City of Novato property west of the HAAF parcel and south of Ammo Hill. This property is about 7 acres and is commonly referred to as the "Bulge" parcel. For this document, the Bulge is defined by the federal property boundary on the east, the existing dirt roads on the south and west, and the levee along Pacheco Pond on the north (see figure 1-1). The area identified in this document as the Bulge parcel does not include any part of the "POL Area" to the south and west nor any part of Landfill 26 to the west. The Bulge was part of the larger Ammo Hill parcel presently owned by the City of Novato, and was transferred from the federal government to the City of Novato as part of the Phase II GSA Sale Property in late 1999. Although the statement of condition does not identify any remaining remedial action for the Bulge parcel, it does note that any additional remedial action found to be necessary after the transfer would be conducted by the federal government through the Department of Defense (U.S. Army Corps of Engineers 1999).

Chemical Suitability of Dredged Material

In the San Francisco Bay region, a consortium of regulatory agencies has been established to address the long-term management of disposal of dredged materials from the Bay. The LTMS agencies—the Corps, EPA, San Francisco Bay RWQCB, BCDC, and SLC—have established a DMMO. The DMMO evaluates dredged material and makes recommendations on its chemical and biological suitability for reuse in wetlands based on testing specific to the proposed site environment and criteria from federal and state laws and guidance documents.

Regional testing guidelines for dredged material are described in Corps Public Notice 01-01, "Proposed Guidelines for Implementing the Inland Testing Manual Within the USACE San Francisco District," and Public Notice 99-4, "Proposed Guidance for Sampling and Analysis Plans (Quality Assurance Project Plans) for Dredging Projects Within the USACE San Francisco District." The RWQCB has

Table 4-8. Results of Phase I Environmental Site Assessment and Phase II Shallow Soil Investigation for the BMKV Expansion Site

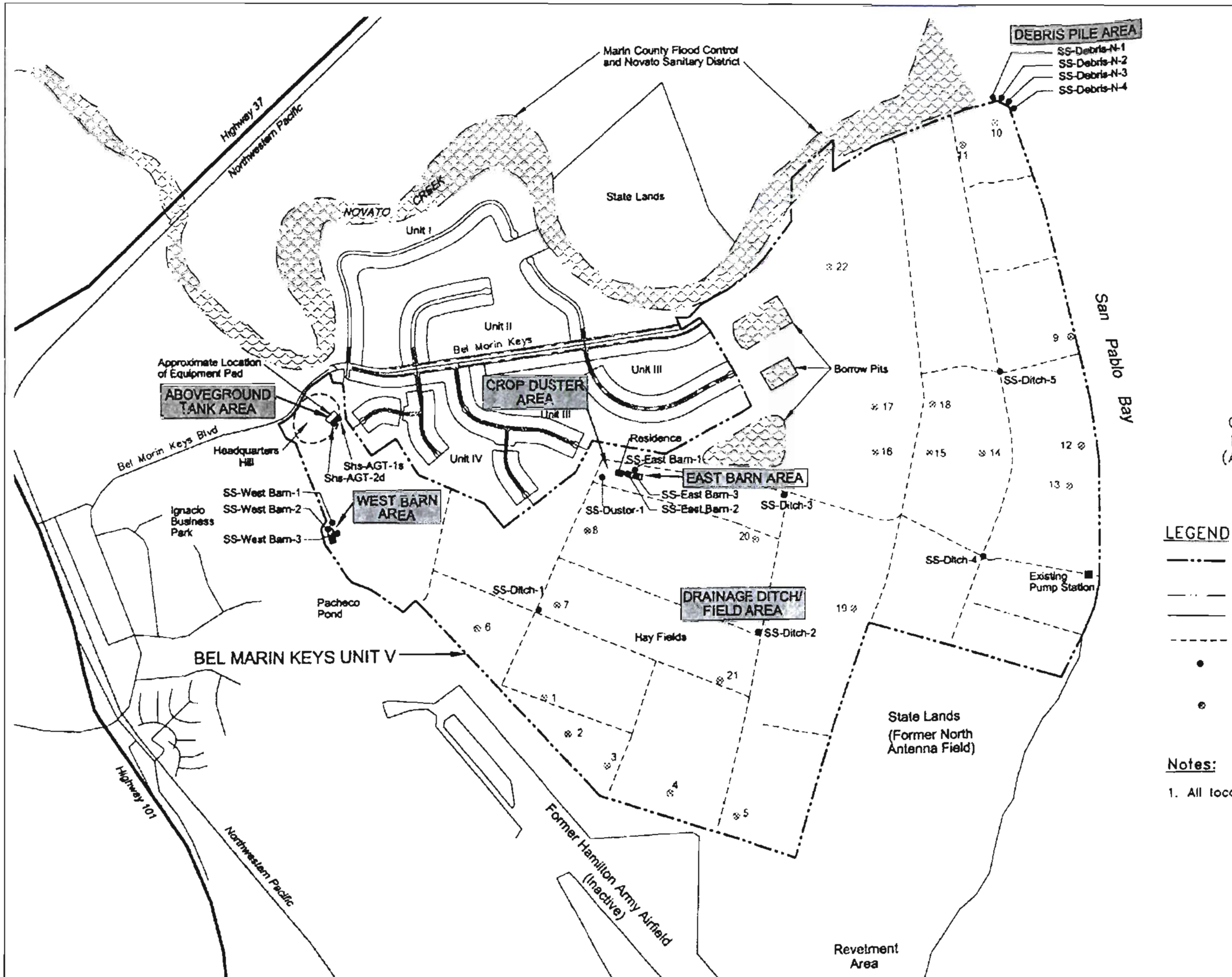
Source	Potential Contaminant(s)	Results[1]
Concrete storage tank pads and dispenser (remnant piping) associated with a potential underground storage tank	Fuel	No observed indicators of prior spills or releases (Phase I)
		Metals detected in soil samples but at concentrations less than the EPA Region IX PRG for residential soil[2]; TPH as diesel detected in soil (Phase II)
Two 55-gallon metal drums	Unidentified liquid	Unidentified liquid visually observed (Phase I)
Several old, inoperative pieces of farm equipment	Vehicle related fluid ground stain	Visually observed fluid leakage (Phase I)
West barn area	Pesticides	DDT detected in soil samples but at concentrations less than the EPA Region IX PRG for residential soil; dioxins and furans detected in soil but at concentrations less than the ATSDR[3] screening level (Phase II)
East barn area	Pesticides	DDT detected in soil samples but at concentrations less than the EPA Region IX PRG for residential soil; dioxins and furans detected in soil but at concentrations less than the ATSDR screening level (Phase II)
Debris pile (150 ft x 30 ft)	Glass bottles, car tires, washing machines, water heaters, engine parts, cans etc.	No obvious hazardous materials were observed at the debris pile (Phase I)
		DDT and its breakdown products (DDD and DDE) detected, but at concentrations less than the EPA Region IX PRG for residential soil; lead (650 mg/kg) and arsenic (36 mg/kg) were the only metals detected in soil samples at concentrations greater than the EPA Region IX PRG for residential soil (Phase II)
Crop duster area	Pesticides, herbicides	None detected in soil samples (Phase II)
Drainage ditches/field	Organic compounds	Dioxins and furans detected in soil samples, but at concentrations less than the ATSDR screening level (Phase II)
East levee pump station intake piping that extends into the drainage ditch	Oils	Lubricant oil staining was visually observed on the piping (Phase I)
Possible septic tank/leach field	Septic/household	Presence unknown (Phase I)

Notes:

(1) Phase I refers to the Phase I site investigation conducted by Miller Pacific Engineering Group in 1994, Phase II refers to the Phase II soil investigation conducted by Erler and Kalinowski, Inc. in 2002. Sources that were investigated in each study may or may not overlap depending on the defined source areas of investigation in each report, which were developed independently.
(2) United States Environmental Protection Agency Region IX, Preliminary Remediation Goals, http://www.epa.gov/region09/waste/sfund/prg/
(3) Agency for Toxic Substances and Disease Registry Dioxin and Dioxin-Like Compounds in Soil, Part 1: ATSDR Interim Policy Guideline, Toxicology and Industrial Health, VoL. 13, No. 6, pp. 759-768, 1997

Sources: Miller Pacific Engineering Group 1994, Erler & Kalinowski, Inc. 2002.

Figure 4-13
Areas of Concern Identified in Prior Phase I and Phase II Studies at the BMKV Parcel



LEGEND

- Approximate Subject Property Boundary
- Creek
- Railroad Tracks
- Existing Ditches
- Approximate Soil Sample Location (Collected by EKI, 2000)
- Approximate Soil Sample Location (Collected by Blymyer, 1989)

Notes:

1. All locations are approximate.

Source: Erler & Kalinowski, Inc 2002

also developed criteria for evaluating the chemical suitability of dredged material for use in tidal and seasonal wetland restoration projects, upland habitat creation, and other upland uses. These criteria are found in the "Interim Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Reuse" (Wolfenden and Carlin 1992). The RWQCB is currently considering an update of these criteria (San Francisco Regional Water Quality Control Board 2000a). In addition, the RWQCB has prepared a TMDL report for mercury in San Francisco Bay, but the TMDL has not yet been formally adopted (San Francisco Regional Water Quality Control Board 2000b).

Source Areas of Hazardous Substances and Waste

The source areas where previous operations or activities may have generated hazardous substances and/or wastes within the BMKV site are described below. Contaminants identified or potentially present and the current remedial status of the SLC and HAAF sites (which are part of the authorized HWRP) are also described below, as is the City of Novato Bulge parcel.

Bel Marin Keys Unit V Expansion Site

Blymyer Engineers Inc. completed a previous environmental site assessment in 1989. The assessment performed shallow-soil sampling tests along the HAAF property boundary and on the BMKV parcel itself to test for petroleum hydrocarbons and herbicides/pesticides. The soil-sampling results showed that no detection of herbicide/pesticide compounds or petroleum hydrocarbons were present at the sampling locations (Miller Pacific Engineering Group 1994).

A Phase I Environmental Site Assessment and a Shallow Soil Investigation were completed in 1994 and 2002, respectively, for the proposed BMKV expansion site. The Phase I assessment identified several items that warranted further attention (Miller Pacific Engineering Group 1994). The Shallow Soil Investigation revealed several source areas on the BMKV site that exhibited low-level contamination due to the presence of various hazardous substances and/or waste (Erler and Kalinowski 2002). The range of contamination for each type of hazardous substance identified in the Shallow Soil Investigation was generally below concentrations as established by the EPA Region IX Preliminary Remediation Goals (PRGs) for residential soil. The results of the Phase I and Shallow Soil studies are summarized in table 4-8. Figure 4-13 illustrates potential areas of concern and sampling locations on the BMKV site, identified in the Phase I and the Shallow Soil studies.

Sediments dredged from the BMK lagoon and possibly Novato Creek were placed on a field in the northeast corner of the BMKV expansion site in the late 1980s. This soil was sampled in 2000 for mercury content. The results are presented in the table 4-9 below. The range of concentrations identified is below

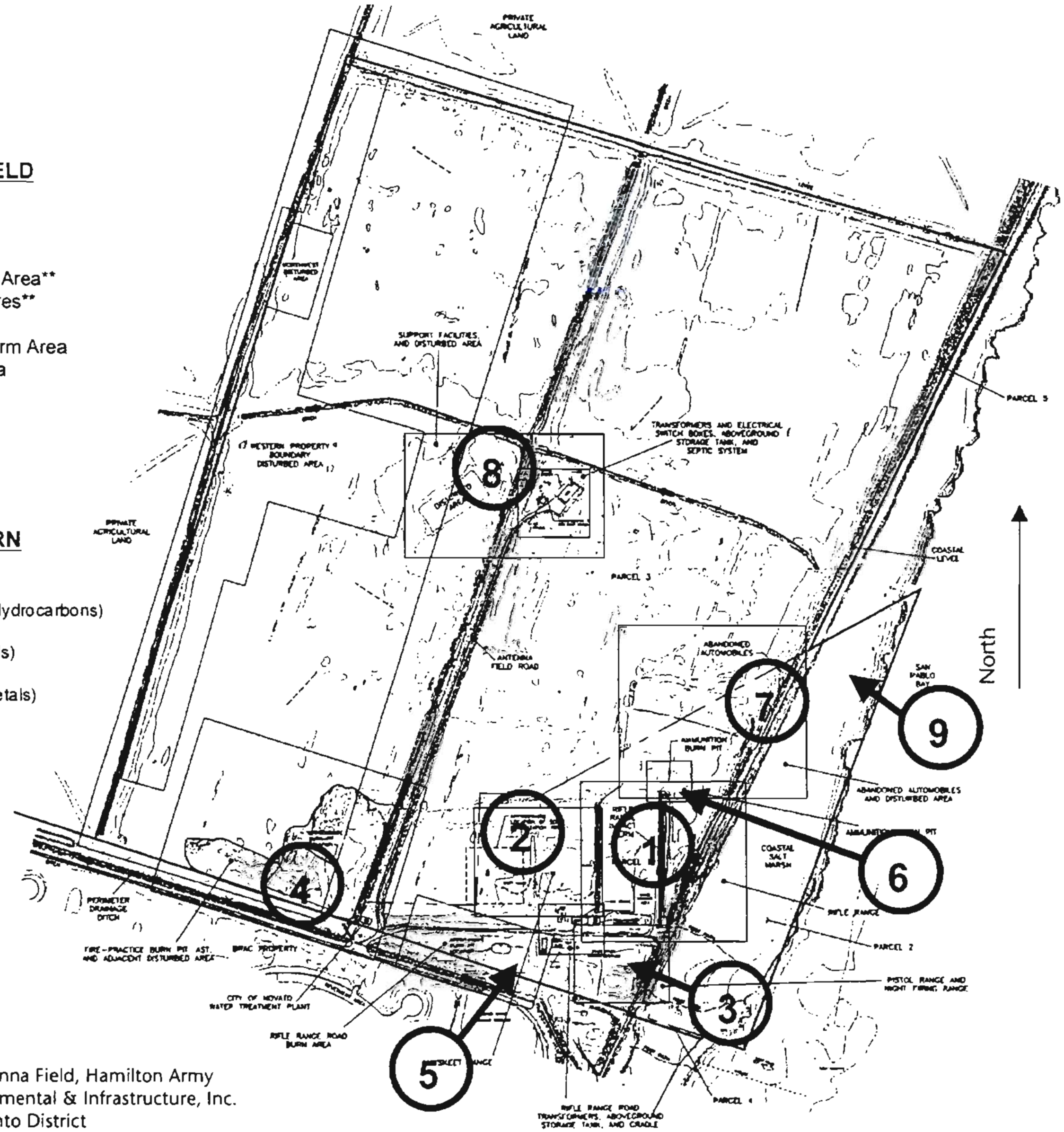
SITE PLAN — NORTH ANTENNA FIELD

1. Rifle Range
2. Trap and Skeet Range
3. Pistol Range and Night Firing Range
4. Fire-Practice Burn Pit and Surrounding Area**
5. Rifle Range Road Burn Pit and Structures**
6. Ammunition Burn Pit**
7. Abandoned Automobiles and Levee Berm Area
8. Support Facilities and Surrounding Area
9. Coastal Salt Marsh

** Interim Removal Action - 1999

GENERAL CHEMICALS OF CONCERN

Site	TYPE (Contaminant)
1-3	RANGES (Metals (Lead) & Polynuclear Hydrocarbons)
4-6	BURN PITS (Dioxin/Furans, TPH & Metals)
7	ABAND. AUTO / LEVEE BERM (TPH, Metals)
8	SUPPORT FACILITIES (TPH & Metals)
9	COASTAL SALT MARSH (Metals)



Source: Draft Remedial Investigation Report, North Antenna Field, Hamilton Army Airfield, Novato, CA - December 2001, Shaw Environmental & Infrastructure, Inc. prepared for U.S. Army Corps of Engineers, Sacramento District

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Figure 4-14
Areas of Concern Identified at the SLC Parcel

the EPA Region IX PRGs for residential soil for mercury (23 mg/kg) and methylmercury (6.1 mg/kg).

Table 4-9. Results of Dredged Material Area Soil Testing (2000) (mg/kg, dry weight)

	Mercury		Methylmercury	
Soil Horizon	Range	Avg.	Range	Avg.
0–6"	0.198–0.496	0.328	0.004–0.021	0.009
6–12"	0.096–0.389	0.268	0.001–0.0096	0.005
12–18"	0.176–0.361	0.270	0.001–0.0325	0.008

Source: Advanced Biological Testing, Inc, April 25, 2000.

State Lands Commission Parcel

The area known as the SLC parcel was transferred to the SLC in 1974 when the Air Force began to relinquish control of the Hamilton property. When the base was active, the parcel supported a variety of uses, including a rifle range, pistol range, and antenna facilities. It was also used at various times for skeet shooting and fire-fighting training. The parcel currently contains antennas and associated cable, aboveground storage tanks, transformers, burn pits, and target practice facilities. A Phase II Site Investigation Report for the SLC site was completed in April 2000 (IT Corporation 2000). The report identified the type and source of contaminants that could potentially be present at the site. The results of the investigation were used to supplement the 1998 initial site investigation results (IT Corporation 2000) for risk evaluation, remedial action planning, and eventual property closure. Six areas were investigated in further detail based on the initial site investigation results.

The *Remedial Investigation Report* for the SLC parcel was completed in 2001 (Shaw Environmental & Infrastructure 2001). The goal of the investigation was to characterize the nature and extent of contamination resulting from military activities. The *Remedial Investigation Report* was a continuance of previous efforts mentioned above, but it also included recent investigations conducted between July 2000 and August 2001. Groundwater, soil, and sediment samples were taken from 13 areas on the SLC parcel. A summary of the report findings is provided below in table 4-10. Figure 4-14 illustrates potential areas of concern on the SLC parcel identified in the report. The next phase of the remedial process is the risk assessment and feasibility study phase, which will evaluate data from the remedial investigation to determine risks posed to human health and the environment and to determine the most appropriate remedial options for the site that are suitable for the intended wetlands use.

Table 4-10. Summary of Draft Remedial Investigation Findings for SLC Parcel

Source Area	Potential Contaminant(s)	Discussion
Coastal Salt Marsh	Lead, other metals associated with ammunition, petroleum hydrocarbons	The estimated area of impact due to lead (9.5 acres) is confined to an area from east of the Small Arms Area to the Abandoned Automobile Area.
Drainage Ditches	Metals, JP-4, insecticides, and herbicides.	All detected at low concentrations. Insecticides and herbicides were detected at trace concentrations.
Antenna Installations	Polychlorinated biphenyls (PCBs)	Two reservoirs of dielectric fluid were found. The first reservoir had PCB levels below the detection limit. The second reservoir was dry and not tested.
Rifle Range	Lead, other metals associated with ammunition, petroleum hydrocarbons	Accumulated between the firing line and the Coastal Levee, with the highest concentrations found at the base of the Coastal Levee behind the target area impact berm.
Trap and Skeet Range	Lead and polynuclear aromatic hydrocarbons (PAHs)	Lead concentrations highest at 350 ft. to 700 ft. from the range fan. Highest PAH concentrations located where clay target fragments were evident; where clay target fragments were found in low quantities or not found, PAHs were either low or not detected.
Pistol and Night Firing Range	Chromium, copper, lead, nickel, and zinc	Contamination is assumed to be associated with site's use for target practice.
Abandoned Automobile Area	Lead and petroleum hydrocarbons	Degraded petroleum hydrocarbon products in diesel range were detected at a maximum concentration of 220 mg/kg. JP-4 was also detected in 2 samples at maximum value of 0.093 mg/kg.
Levee Berm Area	Lead	Lead impacted area begins from the firing line and extends east toward the coastal levee.
Fire Practice Area	PAHs, metals, petroleum hydrocarbons, volatile organic compounds (VOCs), dioxin/furans, and insecticides	Contaminants found throughout the site. There is no spatial distribution associated with the contaminants.
Rifle Range Road	Petroleum hydrocarbons, metals, and dioxin/furans	Concentrations of diesel, motor oil, and JP-4 have been detected in the soil surrounding aboveground storage tanks. The estimated volume of petroleum hydrocarbons in the soil is approximately 7,200 cubic yards.
Support Facilities	Petroleum hydrocarbons	Petroleum hydrocarbons were detected in the soils surrounding aboveground storage tanks and in trace concentrations in the septic system.
Western Property Boundary Area	Petroleum hydrocarbons, dioxin/furans, metals, PAHs, and insecticides	Concentrations of petroleum hydrocarbons, dioxins, metals, PAHs, and insecticides are present in the soil. Most constituents were either below detection limits or at concentrations within the range of Investigation Comparison Levels

Source: Shaw Environmental & Infrastructure 2001.

Hamilton Army Airfield Parcel

An airfield was in operation at Hamilton from 1933 to 1974. During its operation, it was used as a base for fighter squadrons and bombers and was also used as a training installation. The Air Force began to relinquish control of the property in 1974 when Hamilton Air Force Base was listed as excess property. In 1976, the State of California claimed land subject to tidal action on the Hamilton site as state property, and in 1984, the state acquired portions of Hamilton east of the outboard levees Also in 1984, Hamilton was transferred to the Army and renamed Hamilton Army Airfield (HAAF). At that time, land not needed for military air operations was turned over for public sale. In 1988, the BRAC Commission recommended the closure of HAAF. In 1994, aircraft operations ceased and the airfield was closed (CH2M Hill 2001).

As part of the BRAC process, remedial efforts are being conducted at HAAF under a sequence of regulatory phases. The Army identified the nature and extent of contamination during a series of assessments and investigations culminating in the *Comprehensive Remedial Investigation Report* (IT Corporation 1999a). According to the report, a variety of military facilities and functions occurred at Hamilton that could potentially have resulted in soil contamination, including underground storage tanks; aboveground storage tanks; transformers and transformer pads; aircraft maintenance and storage; storm drain and sanitary sewer systems; a former sewage treatment plant; a pump station; fuel lines; revetment areas; construction debris disposal areas; and the perimeter drainage ditch (PDD), which collected runoff from the base and surrounding areas. Based on historical investigation, the contaminants detected at various sites on the Hamilton property include total petroleum hydrocarbons (diesel, gasoline, JP-4, or motor oil), metals, dioxins and furans, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) including polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides (IT Corporation 1999a).

Remedial sites at the HAAF include 58 inboard sites inland of the eastern perimeter levee and 5 coastal salt marsh sites bayward of the perimeter levee. Between 1998 and 1999, interim removal actions were completed on many of the sites where elevated levels of contaminants had been found. A detailed description of site investigation and remedial investigation activities is provided in the *Comprehensive Remedial Investigation Report* (IT Corporation 1999a), interim removal action reports (IT Corporation 1999b and IT Corporation 2000), and the Remedial Design Report (Foster-Wheeler 2000). A human health and ecological risk assessment was completed for both the inboard and the coastal marsh sites in 2001 (IT Corporation 2001). The *Inboard Area Focused Feasibility Study Report* (FFS) was also completed in 2001 for the inboard area of HAAF (CH2M Hill 2001). The purpose of the FFS was to identify areas that required further remedial action and to develop, evaluate, and recommend remedial alternatives for these sites to protect human health and the environment in light of the proposed wetland restoration reuse All of the inboard sites was investigated during the comprehensive remedial investigation and the risk

assessment. The FFS provides a description of each site based on those investigations, and recommends 1 of the following 4 possible remedial alternatives for each site.

- No Further Action–Maintain the property and provide controls, for a prescribed time frame, to prevent access to the area.
- Institutional Controls–Implement non-engineering, legal measures that limit exposure to hazardous substances by restricting land and/or water use.
- Excavation and Offsite Disposal–Remove contaminated soils and ship offsite; backfill excavated area with certified clean fill.
- Excavation and Onsite Disposal–Excavate and remove contaminated soil; transport excavated soils to onsite consolidation site and cap (CH2M Hill 2001).

For detailed discussion of each site and a description of interim remedial actions completed and recommended alternatives, please refer to the *Comprehensive Remedial Investigation Report* and *Inboard Area Focused Feasibility Study Report* (IT Corporation 1999a; CH2M Hill 2001).

A draft feasibility study for the coastal salt marsh sites is currently in regulatory review (Keller pers. comm.)

In 2001, the Corps, St. Louis District, completed an Archives Search Report (ASR) for the HAAF parcel. The ASR reviewed historical information concerning site use. The ASR did not identify any new areas of concern beyond those currently being addressed by the BRAC process and recommended no further actions beyond the continuation of the remedial processes already underway (U.S. Army Corps of Engineers 2001). Because of DTSC and local community group concern, the Army agreed to evaluate whether any of the areas in the ASR warranted further investigation (Keller pers. comm.).

Several other issues related to residual contamination have also been identified within the inboard areas at HAAF, including residual installation-wide pesticides and PAHs in soil near the runway. The Army has identified these issues as not being CERCLA releases, and they are not addressed in the comprehensive remedial investigation or the FFS (see discussion below). However, DTSC believes that these issues are releases under CERCLA. The Army agreed to develop options in the Record of Decision Remedial Action Plan (ROD/RAP) to address potential threats to human health or the environment in light of the future proposed wetland reuse (CH2M Hill 2001).

The next step in the BRAC remedial process for HAAF is development of the ROD/RAP. The Army released a draft final ROD/RAP in 2001. The ROD/RAP certifies that the selected remedy complies with CERCLA, outlines the technical goal of the remedy, provides background information on the site, summarizes the analysis of alternatives, and explains the rationale for the selection of the remedy.

Following the ROD/RAP is the Remedial Design/Remedial Action phase, which is the phase that designs and implements the remedy selected in the ROD/RAP.

City of Novato Bulge Parcel

The proposed location of the interpretive center and access area under Alternative 1 and Revised Alternative 2 is in the center of the Bulge parcel, in the concrete and grassland area between the seasonal wetlands to the north and south (see figures 3-1 and 3-5). No wetland restoration is proposed on this property since it is outside the HWRP boundary.

The Bulge area was reviewed in the remedial investigations conducted for the GSA Phase II Sale Area as well as in the *Comprehensive Remedial Investigation Report*. The Preliminary Assessment for the GSA Phase II Sale Area identified three buildings in the Bulge area, an electrical power station (building 747), a sentry station (Building 748), and a former ready hanger (Building 750) (IT 1996). According to the *Comprehensive Remedial Investigation Report*, the only operations or activities known to have occurred in the area are aircraft takeoff and landing (IT Corporation 1999a). The buildings have all been removed.

No concerns were identified in relation to Buildings 747 and 748. Two underground diesel storage tanks were identified in association with Building 750. The tanks were removed along with contaminated soil in 1987. Subsequent sampling was conducted during a 1997 site investigation. A risk assessment for the site determined that the residual petroleum hydrocarbons in the soil (at 10 feet deep) do not present unacceptable risks. In the Remedial Action Plan (RAP), in relation to the former underground storage tanks, the interim removal action at this location was found to have provided protection of human health and the environment. Continued monitoring of groundwater was recommended in the RAP (IT 1998).

Soil sampling conducted as part of the BRAC remedial process in 1996 identified metals in some samples above baseline values and detected DDE (a breakdown product of DDT) in 2 samples (IT Corporation 1999a). The risk assessment determined that risks to recreational users of the grassland or seasonal wetlands were low related to these results (IT Corporation 2001).

The Statement of Transfer for the Ammo Hill parcel, of which the Bulge parcel is a part, identified that all hazardous substances previously stored on the property had been removed, and determined that all identified releases of hazardous substances on the property had been assessed and appropriately remediated to levels that do not pose a threat to human health or the environment. The Statement of Transfer did not identify any further remedial actions for the area within the Bulge property, as it is defined in this document. (U.S. Army Corps of Engineers 1999.)

Sediment Quality

Dredged Material

An estimated 5,000–40,000 tons of contaminants, comprising at least 65 types of materials, are deposited in San Francisco Bay annually. These contaminants include trace elements such as copper, nickel, silver, zinc, and synthetic organic compounds (e.g., organochlorine pesticides, PCBs, and PAHs). The contaminants originate with numerous industrial, agricultural, natural, and domestic activities and reach the estuary through various means, such as river flow, storm drains, discharges from maritime vessels, and disposal of dredged materials. Many persistent contaminants become bound to particulate matter and accumulate in areas of sediment deposition. Once these contaminants enter the Bay and estuary, their fate is determined by a combination of physical, chemical, and biological processes (U.S. Army Corps of Engineers 1994).

The processes of dredging and placement of dredged materials in San Francisco Bay or in environments such as the proposed expansion site may disturb and redistribute contaminants that have been buried or otherwise sequestered in the sediments. These contaminants, once disturbed, may become biologically available in sediments and water at the site and exert toxic effects upon organisms that come in contact with them. The behavior of contaminants associated with sediments is difficult to predict but is influenced by temperature, amount of oxygen available, degree of acidity, sediment organic-carbon content, salinity, and biological activity. The specific characteristics of each environment in which sediments are deposited will determine the mobility and toxicity of the contaminants and, in turn, the way in which those contaminants can affect organisms.

Dredged material may originate from many sources, including the Port of Oakland 50-foot Deepening Project, Corps operations and maintenance dredging program; and other non-federal dredging projects.

Each dredging project requires a dredging permit, and the quality of sediments is reviewed as part of each permit application by the RWQCB, EPA, and, for nonfederal projects, the Corps. Sufficient data are available to identify, in general terms, the chemical constituents that may be present in dredged sediments from the various potential source locations around the Bay (U.S. Army Corps of Engineers 1994.).

As stated previously, the suitability of dredged material for the expansion site would be determined through the existing testing and suitability framework used by the state and federal agencies charged with approving placement of material dredged from San Francisco Bay through the DMMO. The agencies require dredging project applicants to sample and test sediments proposed to be dredged for chemical constituents of concern and for toxicity, using protocols acceptable to the agencies. The adequacy of the sampling and testing is evaluated by the DMMO, which then reviews the test results to evaluate the acceptability of the dredged material for placement at proposed sites in the Bay, ocean, wetland, or upland environments.

To aid in determining the suitability of dredged material for use in wetland environments, the RWQCB has developed guidelines, known as the Wolfenden and Carlin Guidelines (Wolfenden and Carlin 1992), that identify screening criteria for contaminant levels for use in wetland projects. The RWQCB is currently considering an update of these screening criteria to include the results of recent ambient sediment sampling and other sediment studies (Regional Water Quality Control Board 2000a). The DMMO would use these guidelines to assess any dredged material proposed for use at the expansion site.

Two types of material may be placed at upland/bayland sites and used for wetland creation or restoration, based generally on the concentration of particular contaminants and the results of bioassays. These materials are described below.

- Cover sediments are those that would pass leaching and bioassay tests and contain certain contaminants at concentrations less than those specified in the RWQCB's interim screening criteria. The interim screening criteria are shown in table 4-11 compared to ambient-level thresholds of the same contaminants in the Bay. New draft screening criteria for cover material proposed in 2000 are, for the most part, based on ambient thresholds. Cover material can be used in wetland creation and restoration areas, for levee construction, and for covering noncover materials. DMMO may also take into account local ambient sediment quality when considering site-specific determinations for locally appropriate cover criteria.
- Noncover sediments are those that pass leaching tests and have contaminant concentrations that exceed criteria for cover sediments, but do not exceed the criteria for noncover sediments. Noncover material must be covered on the top and sides by a minimum of 3 feet of cover material or material native to the site.

Table 4-11. San Francisco Bay Sediment Screening Criteria and Ambient-Level Thresholds (mg/kg)

	RWQCB 1992 Sediment Screening Criteria[1]		RWQCB Draft 2000 Sediment Screening Criteria[2]		Ambient-Level Thresholds[3]
Analyte	Cover	Noncover	Cover	Noncover	<100% fines
Arsenic	33	85	15.3	70	15.3
Cadmium	5	9	0.33	9.6	0.33
Chromium	220	300	112	370	112
Copper	90	390	68.1	270	68.1
Lead	90	110	43.2	218	43.2
Mercury	0.35	1.3	0.43	0.7	0.43
Nickel	140	200	112	120	112
Selenium	0.7	1.4	0.64		0.64
Silver	1.0	2.2	0.58	3.7	0.58
Zinc	160	270	158	410	158
PCBs (Total)	0.05	0.4	0.0227	0.180	.0148
Pesticides (Total DDT)	0.003	0.1	0.007	0.0461	.007
PAHs (Total)	4	35	3.39	44.792	3.39

1 = Wolfenden, John D. and Michael P. Carlin, Interim Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Reuse, prepared for California Regional Water Quality Control Board, San Francisco Bay Region, December 1992.

2 = San Francisco Regional Water Quality Control Board (SF RWQCB), Draft Staff Report, Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines, May, 2000.

3 = SFRWQCB 1998, Ambient Concentrations of Toxic Chemicals in San Francisco Bay Sediments, May 1998. Note that these thresholds are based on the 85^{th} percentile for 100% fines based on statistical evaluation of ambient concentrations found in reference sediment samples.

Although the current and draft screening criteria specify slightly differing guidelines for cover material (which can be used anywhere in a wetland) and noncover material (which needs to be properly buried), only material appropriate for cover, as determined by the DMMO, would be accepted for use at the expansion site. Separate tests for contaminant leaching are used to evaluate the acceptability of material for upland disposal. Only material found suitable by the DMMO would be used as part of the upland components of the proposed BMKV expansion.

Mercury Concentrations in Novato Creek and San Pablo Bay Sediments

Because the restoration alternatives include breaches to San Pablo Bay and Novato Creek and would either rely on natural sedimentation for wetland formation or receive natural sedimentation after deposition of dredged material, sediments from the adjacent portions of San Pablo Bay and Novato Creek would be deposited within parts of the wetland restoration site. As described above, in general for San Francisco Bay sediments, a variety of natural and anthropogenic sources of chemical constituents have influenced the sediment chemistry of Novato Creek. Mercury has been identified as a constituent of concern in San Pablo Bay and in Novato Creek.

Sediment sampling was conducted by the BMK CSD in 1996, including samples collected from Novato Creek just north of the BMKV site. With the exception of mercury, all of the metals detected in the samples were at concentrations below the 1992 interim sediment screening criteria. Mercury was detected in a composite of the 2 Novato Creek sediment samples at concentration (0.74 mg/kg, dry weight) above the RWQCB current and proposed wetland cover screening criteria (Advanced Biological Testing 1997).

Sediment sampling was also conducted by the BMK Homeowners Association concerning mercury in sediments in Novato Creek (Advanced Biological Testing 2000). Some of the sediments exceed the RWQCB current and proposed wetland cover screening criteria for mercury. The results are summarized in table 4-12 below.

Table 4-12. Results of Novato Creek Sampling (2000)

	Mercury (mg/kg, dry weight)		Methylmercury (mg/kg)	
	Range	Average	Range	Average
Sediments (0–6")	0.273–0.479	0.384	0.001–0.0228	0.011
Sediments (6–12")	0.348–0.511	0.424	0.0011–0.0261	0.008
Sediments (12–18")	0.338–0.506	0.397	0.0017–0.0434	0.014

Samples collected from north of BMKV near mouth of creek and from upstream/downstream of Hwy 37.

Source: Advanced Biological Testing, Inc, April 25, 2000

The San Francisco RWQCB has analyzed ambient conditions throughout San Francisco Bay, including San Pablo Bay. The results for mercury are summarized in table 4-13 below. The reference site results for San Pablo Bay indicate that mercury concentrations meet the current and proposed RWQCB screening criteria for wetland cover.

Table 4-13. San Pablo Bay/Carquinez Strait Reference Site Sampling

	Mercury (mg/kg)		
	Paradise Cove	Tubbs Island	Island # 1
San Pablo Bay/Carquinez Reference Sites	0.304	0.35	0.274

Source: San Francisco Regional Water Quality Control Board 1998

In June 2002, the BMK CSD sampled sediment from the Bel Marin Keys north lagoon and Novato Creek. Sediment and elutriate samples were analyzed for mercury content. Results from the sediment analyses indicated mercury concentrations ranging from 0.31 to 0.37 mg/kg dry weight (MEC 2002). Reference site (sometimes referred to as a "background"site) sampling results for mercury in San Pablo Bay are noted in table 4-13. The ambient level threshold for mercury for fine grain sediments in the San Francisco Bay, as noted in table 4-12, is 0.43 mg/kg (San FranciscoRegional Water Quality Control Board 1998). The elutriate analyses showed mercury concentrations ranging from 4.78 and 6.71 nanograms/liter (ng/L) (MEC 2002). The RWQCB mercury water quality objective for mercury is 25 ng/L (San Francisco Regional Water Quality Control Board 1995).The Corps and Conservancy are not making any determinations at this time regarding the suitability of dredged material proposed for use at the BMKV expansion. That determination would be made by the DMMO. As noted above, the purpose of the DMMO is to cooperatively review sediment quality sampling plans, analyze the results of sediment quality sampling and make suitability determinations for material proposed for disposal in San Francisco Bay, including proposals for reuse in wetland restoration. Also, as noted above, DMMO may take into account local (e.g. Novato Creek or San Pablo Bay) ambient conditions when making determinations of appropriate criteria for wetland criteria.

Environmental Consequences and Mitigation Measures

Approach and Methods

The approach and methods used to evaluate hazardous substances and waste consisted of reviewing available reports regarding potential contaminants present at the site. In addition, data were reviewed regarding contaminant concentrations in potential dredged material proposed for reuse at the site. Potential impacts on public health from the release of onsite or imported contaminants were reviewed, including an assessment of toxicity and potential exposure pathways.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding hazardous substances and waste, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- create a potential public health hazard; or
- involve the release of onsite contaminants or imported contaminants that pose a hazard to human, animal, or plant populations in the area affected.

Impacts and Mitigation Measures of No-Action Alternative

No new impacts related to hazardous waste would occur under the No-Action Alternative. Regardless of final disposition of the proposed wetland site, identification, remediation, and/or disposal of hazardous waste would be performed as necessary by the Conservancy in accordance with appropriate local, state, and federal regulations. The required level of remediation, however, may vary based on the selected final use of the expansion area. With no BMKV expansion, the HWRP would proceed as proposed on the HAAF and SLC parcels only. Thus, the BRAC and FUDS processes would continue to consider the future proposed wetlands use at the HAAF and SLC parcels.

No impacts associated with sediment quality would occur because no dredged material would be imported onto the BMKV or SLC parcels.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact HAZ-1: Potential Exposure of Humans, Plants, or Wildlife to Contaminants as a Result of Remediation Activities for the Proposed Action

The lead agencies are required to perform appropriate cleanup of all hazardous waste sites located on the BMKV site, as well as on the SLC and HAAF sites (which are part of the authorized HWRP) in accordance with RCRA, CERCLA, CCR Title 26, and other applicable local, state, and federal regulations.

The BMKV expansion makes no determinations whatsoever regarding potential remedial activities at the SLC parcel or the HAAF parcel. The lead agencies presume that the BRAC and FUDS processes will result in implementation of remedial approaches that provide cleanup of any contaminated sites to a condition suitable for the proposed wetland use, and this is the basis for analysis

in this document In addition, it is presumed that the SLC and HAAF parcels will be made suitable for wetland reuse by the BRAC and FUDS processes such that no significant impact related to potential human or ecological exposure to contaminants would be expected. If the remedial determinations ultimately made through BRAC or FUDS require changes in the wetland designs proposed for the HAAF or SLC parcels, then the lead agencies will evaluate the potential effects of the changes and determine whether additional NEPA/CEQA compliance would be necessary for that portion of the HWRP.

The Statement of Transfer for the Ammo Hill parcel, of which the City of Novato-owned Bulge parcel is a part, did not identify any additional remedial requirements for the area within the Bulge property, as the property is defined in this document (U.S. Army Corps of Engineers 1999). The Statement of Transfer also identified that all hazardous substances previously stored on the property had been removed, and determined that all identified releases of hazardous substances on the property had been assessed and appropriately remediated to levels that do not pose a threat to human health or the environment (U.S. Army Corps of Engineers 1999). Based on the conclusion in the Statement of Transfer, no significant impacts related to hazardous substances are identified for the proposed recreational use of a portion of the Bulge parcel.

According to the Phase I and Phase II assessments of the BMKV expansion site, evidence of significant hazardous substances was not found on the BMKV parcel. Shallow-soil sampling conducted in the Phase II site assessment revealed the presence of metals, diesel fuel residue, DDT, dioxins, and furans within soils in several areas on the BMKV parcel. Detections of DDT and most metals in soils were at concentrations less than their corresponding EPA Region IX PRGs for residential soil, with the exception of lead and arsenic in a sample from beneath a debris pile. Dioxins and furans were detected in several soil samples but at concentrations less than the Agency for Toxic Substances and Disease Registry (ATSDR) screening levels for evaluation (Agency for Toxic Substances and Disease Registry 1997).

Debris pile samples contained concentrations of lead, several other metals, and DDT (and its breakdown products) greater than the cover and/or non-cover RWQCB sediment screening criteria in table 4-11. One of the samples from the aboveground tank area contained lead above the cover and non-cover screening criteria in table 4-11; one of the samples from the east barn area contained concentrations of DDT greater than the cover and non-cover RWQCB sediment screening criteria; and one of the samples from the west barn area contained concentrations of DDT greater than the RWQCB cover screening criteria.

Although the areas affected by potential soil contamination on the BMKV site are limited, if left in place, there is the possibility of exposure of any associated contamination in the restoration area. To reduce this impact to a less-than-significant-level Mitigation Measure HAZ-1 would be implemented. The SLC parcel, which is part of the authorized HWRP, is being remediated under the FUDS program. The HAAF parcel, which is also part of the authorized HWRP,

is being remediated under the BRAC program. The lead agencies are required to investigate and remediate identified toxic or hazardous substances to reduce the risk of exposure to humans and prevent ecological degradation. Because of the cleanup requirements discussed above, the existing remedial processes for the SLC and the HAAF parcels, and the mitigation measures below for the BMKV site, the potential to expose humans, plants, and wildlife to contaminants is considered less than significant.

Mitigation Measure HAZ-1: Coordinate with Department of Toxic Substances Control on BMKV Site Clean-Up Requirements Prior to Construction.

The Conservancy shall coordinate with DTSC on defining DTSC's requirements for BMKV site clean-up based on the results of the Phase I and II site investigations. The requirements could include clean-up measures described in the Phase I study, as appropriate, potentially including limited soil removal and additional testing, as determined in consultation with DTSC, to address the identified concerns on the BMKV site. These measures should be evaluated in light of the proposed wetland reuse and implemented prior to construction, as appropriate and in coordination with the DTSC. Any remedial activities will be in compliance with applicable local, state, and federal regulations.

Impact HAZ-2: Potential Exposure of Humans, Plants, or Wildlife to Hazardous Chemicals Contained in Dredged Material Used as Fill Material

The process of dredging material from various sources and placing this material to expedite creation of wetlands could disturb and redistribute contaminants that have been buried or otherwise sequestered in the sediments. Once disturbed, these contaminants may become biologically available in sediments and water while being deposited at the site and may exert toxic effects on organisms that come in contact with them. Sediment screening would be conducted in accordance with the current requirements established by the DMMO, Corps, RWQCB, and other LTMS agencies.

Because the proposed BMKV expansion would make use of only cover-quality dredged material that satisfies the cover criteria, this impact is considered less than significant in regards to sediment quality, and no mitigation is required (see below concerning water quality).

As described in the *Water Quality* section in this chapter, although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into toxic methylmercury. Although it is likely that mercury methylation would increase as a result of the dredged placement approach, it is not clear whether the act of placement causes more notable effects than the act of dredging or whether either of those effects are more notable than the natural methylation processes. Because no definitive conclusion can be made about this

impact, it is considered significant. To reduce this impact, mitigation measure WQ-1, as proposed in the *Water Quality* section, would be implemented.

Impact HAZ-3: Potential Exposure of Humans, Plants, or Wildlife to Hazardous Chemicals due to Sedimentation from Novato Creek and/or San Pablo Bay

The final sediment layer in the three restoration alternatives would come from sediment carried to the site by Novato Creek, nearby Petaluma River, and San Pablo Bay, As described above, in some of the prior sampling efforts (although apparently not in the most recent 2002 sampling), some of the sediments in Novato Creek have concentrations of mercury that are greater than the existing and proposed cover-sediment screening criteria. However, the sample results reviewed for creek sediments near the site, for the most part did not indicate concentrations of mercury greater than the existing or proposed noncover criteria. Sampling to date has been limited, and conclusions about the quality of Novato Creek sediments could change if more detailed and extensive site-specific studies were conducted. It is also possible that some sediments near the site in San Pablo Bay may have concentrations of mercury greater than the sediment screening criteria for cover material.

Although only cover-quality dredged material would be used for wetland-creation fill, natural sedimentation after breaching would result in migration of sediment into the restoration area, with potential concentrations of mercury in some sediments being greater than the cover-sediment screening criteria. While sediments from Novato Creek and San Pablo Bay would nominally have ambient concentrations of mercury, this would not eliminate the potential for mercury methylation in the restored wetland area.

The primary concern about the deposition of sediments that contain elevated concentrations of mercury in the wetland restoration area is that it may increase the rate of mercury methylation, which could affect water quality. Due to the biomagnification potential of methylmercury, increased methylation could affect wildlife that may utilize the restoration site or nearby environments. However, it is not currently possible to estimate the methylmercury concentrations or bioaccumulation and biomagnification in the food chain that may occur. As discussed in the *Water Quality* section, because a clear conclusion cannot be made at this time regarding the potential for a significant adverse effect on the environment, this impact is considered significant and unavoidable. Mitigation WQ-1, a methylmercury adaptive management plan, is proposed to be developed in concert with the appropriate regulatory agencies, including those responsible for protection of biological resources such as DFG, USFWS, and NMFS. See the *Water Quality* section for further discussion.

Transportation

This section analyzes the potential effects of the proposed BMKV expansion on traffic and transportation.

Affected Environment

Data Sources

Information presented in this section is based on the following data sources.

- *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998)
- *Environmental Analysis of Tidal Marsh Restoration in San Francisco Bay* (San Francisco International Airport 2001)

Roadway Network

Regional Access

Regional access to the expansion site is provided by U.S. Highway 101 and State Route 37. U.S. Highway 101 is a principal north–south freeway that connects the expansion site to Sonoma County to the north and the San Francisco Bay Area to the south. State Route 37 extends east from U.S. Highway 101 in Novato to Interstate 80 in Vallejo.

Access to BMKV Expansion Area

Current access to the BMKV site is provided by Ignacio Boulevard and Bel Marin Keys Boulevard. Ignacio Boulevard provides access to the site from U.S. Highway 101, turning into Bel Marin Keys Boulevard as the site is approached from the west. No public roadways exist within the BMKV parcel. The existing private roads on the site are used primarily for agricultural operations.

In the 1998 EIS/EIR for the original HWRP, the identified construction access to the HWRP is from Nave Drive to New Hamilton Parkway to Todd Road to the HAAF parcel. As described in Chapter 3, this would be the primary access route to the BMKV expansion site and Bel Marin Keys Boulevard would be the secondary access route.

The SLC site may be accessed by a legally deeded access easement across the HAAF site. Although no official map of the easement exists, it is described as a

40-foot easement that extends from the entrance of the HAAF site to the SLC property. The easement is located adjacent to the Bay, and crosses over existing roads, including Main Gate Road, Palm Drive, Hangar Avenue, and Perimeter Road.

Existing Levels of Service

Traffic and transportation movement is measured by a level of service (LOS) rating, which ranges from A to F. LOS A is operationally the most efficient and generally exhibits the least amount of traffic delays and resulting congestion. Each successive LOS (B through F) is less operationally efficient. Standard descriptions of LOS service are provided in tables 4-14 (following this page) and 4-15. The existing LOS for the 2 critical intersections that provide access to the expansion area from Highway 101 are estimated to range from B to D during a.m. and p.m. peak hours (see table 4-16). The LOS for existing peak-hour freeway operations is estimated to range from D to E/F on U.S. Highway 101 and is estimated at B on State Route 37, within the vicinity of the expansion area.

Table 4-15. Unsignalized Intersection LOS Criteria

Level of Service	**Description**	**Average Control per Vehicle (Seconds)**
A	Little or no delays.	≤ 10.0
B	Short traffic delays.	> 10.0 to 15.0
C	Average traffic delays.	> 15.0 to 25.0
D	Long traffic delays.	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic delays with intersection capacity exceeded.	> 50.0

Source: Transportation Research Board Highway Capacity Manual, 2000.

Table 4-16. Intersection Level of Service and Peak-Hour Freeway Operations

	LOS	
Intersection	A.M.	P.M.
Ignacio Boulevard/U.S. Highway 101 southbound ramps	D	C
Ignacio Boulevard/U.S. Highway 101 northbound ramps	B	D

Source: Hamilton Wetland Restoration Plan EIR/EIS, 1998.

Table 4-14. Signalized Intersection LOS Criteria

LOS	Sum of Critical Volume to Capacity Ratio	Description
A	< 0.60	Operations with very low control delay, up to 10 seconds per vehicle. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
B	0.61 – 0.70	Operations with control delay great than 10 and up to 20 seconds per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of average delay.
C	0.71 – 0.80	Operations with control delay greater than 20 and up to 35 seconds per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.
D	0.81 – 0.90	Operations with control delay greater than 35 seconds and up to 55 seconds per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable .
E	0.91 – 1.00	Operations with control delay greater than 55 and up to 80 seconds per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. The individual cycle failures are frequent occurrences.
F	> 1.00	Operation with control delay in excess of 80 seconds per vehicle. This level, considered to be unacceptable with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.

Source: Contra Costa Transportation Authority, Technical Procedures, 1997.

Environmental Consequences and Mitigation Measures

This section analyzes impacts on transportation associated with construction and operation of each restoration alternative. Impacts associated with transporting materials from the dredge site to the hydraulic off-loaders have been evaluated as part of other environmental documentation for the Oakland Harbor navigation improvement project (U.S. Army Corps of Engineers and Port of Oakland 1998a, 1998b, 1998c, and 1998d). The document concluded that transporting dredged material by barge would not result in a significant impact on transportation.

Approach and Methods

Implementation of the proposed BMKV expansion could result in impacts associated with construction, operation, and maintenance of the expansion site. Construction-related impacts could result from trips made by construction workers to and from the expansion site. Operation and maintenance impacts may occur as a result of trips made to the site by caretakers, researchers, or visitors.

Assigning LOS is a quantitative method for describing traffic conditions on intersections and road segments. LOS ranges from A (uncongested) to F (totally congested). Under the No-Action Alternative, it is assumed that existing land uses would remain the same, and therefore there would be no increase in existing traffic conditions at major intersections providing access to the site, as shown in table 4-16.

The total number of daily trips generated during the construction phase of the proposed BMKV expansion was based on the equipment estimates for the construction phase of the proposed BMKV expansion. The largest number of construction vehicles would be used during the enhancement and construction of perimeter and internal levees. Based on the number of pieces of construction equipment needed, construction of the proposed BMKV expansion was estimated to result in an increase of up to approximately 72 daily vehicle trips to the expansion site, including 17 trips during each morning and evening commute period, and 10 during the lunch hour. The methods and assumptions used to arrive at this estimate are described in appendix E.

Visitation by the public would be allowed after construction is completed. Public use would be restricted to the interpretive center and the Bay Trail routes that are proposed around the perimeter and within the expansion site. Trips associated with public use and operation and maintenance of the proposed BMKV expansion are expected to be minimal and are not expected to affect circulation patterns or capacity at nearby intersections or roadway alignments. Parking would be provided at the interpretive center/access area/trailhead.

Impact Mechanisms

Construction of the proposed BMKV expansion is the impact mechanism that would affect transportation, particularly construction related to perimeter and internal levee enhancement and creation.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding transportation, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- cause the LOS at local intersections to increase to unacceptable levels (typically, from LOS D or better to LOS E or F);
- substantially increase traffic volumes such that traffic increases along freeways or ramps that previously had an acceptable LOS;
- contribute substantially to traffic congestion at local intersections, ramps, or freeways that already operate at an unacceptable LOS; or
- interfere with existing transportation systems, causing substantial alteration by exceeding existing or proposed transit capacity, or cause transit delays, by resulting in an unacceptable LOS.

Impacts and Mitigation Measures of the No-Action Alternative

Under the No-Action alternative, no restoration activities would occur, and no impact on LOS at major intersections and roadway segments adjacent to the expansion area would occur.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact T-1: Change in LOS at Important Intersections and Roadway Segments during the Construction Phase

Restoration activities would increase the number of vehicle trips to the expansion site by an estimated 17 daily construction-worker vehicles per day under Alternatives 1–3 during the site preparation phase. Including construction vehicle activity from the site, this could result in up to approximately 72 vehicle trips to and from the site on a daily basis for several years. Dredged material would then be placed on the expansion site under Phase 2 of site construction,

"Dredged Material Placement." Phase 2 would last approximately 10 years under Alternative 1 and Revised Alternative 2, and 3 years under Alternative 3. During Phase 2, the number of construction vehicles travelling to and from the site would largely decrease because construction activities would focus on off-loading dredged material to the site. Therefore, the placement of dredged material requires far less construction equipment travelling to and from the site on a daily basis. Following the placement of dredged material on the site, Phase 3, "Earthwork and Tidal Connection," would last approximately 1 year for each alternative and would increase the number of construction vehicles travelling to and from the site from Phase 2. The number of vehicles expected during Phase 3 would not exceed the number of estimated vehicles under Phase 1 of site construction.

Based on the existing LOS for intersections and roadway segments shown in table 4-16, the expected daily increase in construction traffic would not change the LOS on freeway alignments or important intersections that support the expansion site. Because the minimal increase in daily traffic is not expected to result in a change in LOS, the impact on transportation under Alternatives 1–3 is considered less than significant. No mitigation is required.

Impact T-2: Change in LOS at Important Intersections and Roadway Segments during the Operation Phase

During the operation phase of the proposed BMKV expansion under Alternatives 1–3, a minimal number of trips to the expansion site would be required for maintenance and monitoring activities and for access to the Bay Trail and interpretive center. The number of daily trips expected under the operation phase of the proposed BMKV expansion would be greatly reduced from the construction phase of the proposed BMKV expansion. The number of additional trips attributable to maintenance and monitoring and recreational users would be small compared to the existing volume of traffic at intersections and roadway segments that support the expansion site. A small amount of parking (10 to 20 spaces) would be provided at the interpretive center location. Impacts on traffic circulation attributable to operation of the proposed BMKV expansion are considered less than significant because the LOS at roadway segments and intersections is not expected to change. No mitigation is required.

Air Quality

Affected Environment

Data Sources

The existing air quality conditions for the proposed expansion area were defined using information provided in the *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998). In addition, the Bay Area Air Quality Management District's (BAAQMD's) guidelines for assessing air quality impacts were used to evaluate the environmental effects associated with the proposed restoration alternatives (Bay Area Air Quality Management District 1999).

Climate

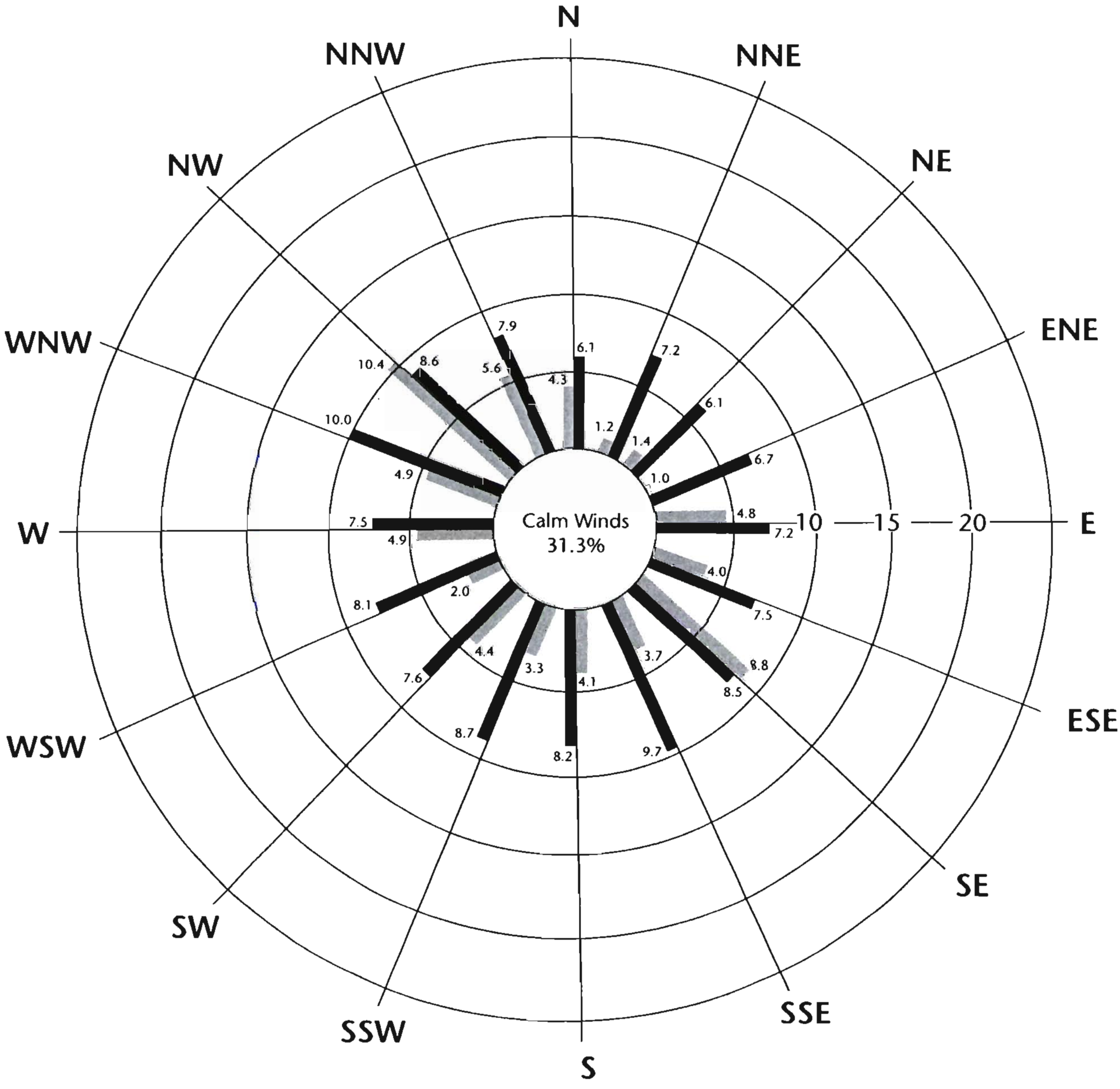
The concentration of a given pollutant in the atmosphere is determined by the amount of pollutant released and the atmosphere's ability to transport and dilute the pollutant. The major determinants of air pollution transport and dilution are wind, atmospheric stability, terrain, and insolation.

The topography of Novato is generally flat, and elevation is less than 100 feet above sea level. The expansion area is characterized by warm, dry summers and cool, moist winters.

Figure 4-15 shows the wind rose for a meteorological station located at HAAF, which is adjacent to the expansion area. The wind rose shows the percentage of time wind blows in each direction and the mean wind speed by direction. Annually, the predominant wind direction is from the northwest. During spring and fall, the predominant direction is from the west-northwest. The predominant wind direction is from the east-southeast during summer and from the north-northwest during winter. Mean wind speeds range from 5 to 10 miles per hour, and calm winds occur 31.3% of the time (California Air Resources Board 1984).

Federal and State Ambient Air Quality Standards

The State of California and the federal government have each established ambient air quality standards for air pollutants (see table 4-17). For some pollutants, separate standards have been set for different periods, with most standards set to protect public health; however, for some pollutants, standards have been based on other values, such as protection of crops, protection of materials, or avoidance of nuisance conditions.



Based on 278,159 hourly observations from 1939 to 1970 at Hamilton Army Force Base

Source: California Air Resources Board 1984.

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Jones & Stokes

nhc northwest hydraulic consultants

Figure 4-15
Wind Rose Depicting Average Wind Speed and Directional Frequency at Hamilton Army Airfield

Table 4-17. Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	State Standard	Federal Standard
Ozone	8 hours	—	0.08 ppm
	1 hour	0.09 ppm (180 μg/m³)	0.12 ppm (235μg/m³)
Carbon Monoxide	8 hours	9.0 ppm (10 mg/m³)	9 ppm (10 mg/m³)
	1 hour	20 ppm (23 mg/m³)	35 ppm(40 mg/m³)
Nitrogen Dioxide	annual average	—	0.053 ppm (100 μg/m³)
	1 hour	0.25 ppm (470 μg/m³)	—
Sulfur Dioxide	annual average	—	80 μg/m³ (0.03 ppm)
	24 hours	0.04 ppm (105 μg/m³)	365 μg/m³ (0.14 ppm)
	1 hour	0.25 ppm (655 μg/m³)	—
Particulate Matter (PM10)	annual arithmetic mean	—	50 μg/m³
	annual geometric mean	30 μg/m³	—
	24 hours	50 μg/m³	150 μg/m³
Particulate Matter—Fine (PM2.5)	annual arithmetic mean	—	15 μg/m³
	24 hours	—	65 μg/m³
Sulfates	24 hours	25 μg/m³	—
Lead	calendar quarter	—	1.5 μg/m³
	30-day average	1.5 μg/m³	—
Hydrogen Sulfide	1 hour	0.03 ppm (42 μg/m³)	—
Vinyl Chloride (chloroethene)	24 hours	0.010 ppm (26 μg/m³)	—
Visibility-Reducing Particles	8 hours (1000–1800 PST)	*	—

Notes: ppm = parts per million
mg/m³ = milligrams per cubic meter
μg/m³ = micrograms per cubic meter

* Statewide VRP Standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70%. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range.

The air pollutants of greatest concern in the expansion area include carbon monoxide (CO), ozone, and inhalable particulate matter less than 10 microns in diameter (PM10).

State and Federal Attainment Status

The San Francisco Bay Area Air Basin (SFBAAB) includes the City of San Francisco; portions of Sonoma and Solano Counties; and all of San Mateo, Santa Clara, Alameda, Contra Costa, Marin, and Napa Counties.

The SFBAAB is currently classified as a nonattainment area for the state PM10 standards and for the state and federal ozone standards. The SFBAAB is an attainment area for the federal PM10 standards and for the state and federal NO2 and SO2 standards. The SFBAAB is also an attainment area for the state CO standards and a maintenance area for the federal CO standards.

State and Federal Air Quality Management Programs

Air pollution control programs were established in California before the enactment of federal requirements. Federal Clean Air Act legislation in the 1970s resulted in a gradual merging of state and federal air quality programs, particularly those relating to industrial sources. Air quality management programs developed in California since the late 1980s have generally responded to requirements established by the federal Clean Air Act.

The enactment of the California Clean Air Act in 1988 and the federal Clean Air Act Amendments of 1990 has produced additional changes in the structure and administration of air quality management programs. The California Clean Air Act requires preparation of an air quality attainment plan for any area that violates state air quality standards for CO, sulfur dioxide (SO2), nitrogen dioxide (NO2), or ozone. Locally prepared attainment plans are not required for areas that violate the state standards for PM10. The California Air Resources Board (CARB) is addressing PM10 attainment issues.

Air pollution problems in the SFBAAB are primarily the result of locally generated emissions. The SFBAAB, however, has been identified as a source of ozone precursor emissions, which occasionally contribute to air quality problems in the Monterey Bay area, the northern San Joaquin Valley, and the southern Sacramento Valley. Consequently, in addition to correcting local air pollution problems, air quality planning efforts for the SFBAAB must also reduce the area's impact on downwind air basins.

The BAAQMD has prepared 2 recent air quality plans designed to bring the SFBAAB into attainment with ozone standards. The 1999 Ozone Attainment Plan was designed to bring the SFBAAB into attainment with the federal ozone ambient air quality standards. It was approved by the CARB but was partially

disapproved by the U.S. EPA (Bay Area Air Quality Management District, Metropolitan Transportation Commission, and Association of Bay Area Governments 1999; www.BAAQMD.gov). This plan contained 11 control strategy measures that would have included development and implementation of additional air quality rules and regulations for emission sources within the SFBAAB. A Bay Area 2001 Ozone Attainment Plan is currently being prepared by the BAAQMD, the Metropolitan Transportation Commission, and the Association of Bay Area Governments. This plan is a proposed revision to the Bay Area portion of California's plan to achieve the national ozone standard. The plan is being prepared in response to EPA's partial approval and partial disapproval of the Bay Area's 1999 Ozone Attainment Plan.

On December 20, 2000, the BAAQMD adopted the 2000 Clean Air Plan (CAP) (Bay Area Air Quality Management District 2000). The CAP represents the third triennial update of the 1991 CAP. It contains additional rules and regulations that are designed to bring the SFBAAB into attainment with the California ozone ambient air quality standards.

Federal Clean Air Act Conformity

As required by the 1990 Federal Clean Air Act Amendments, EPA enacted 2 separate federal conformity rules. Those rules (incorporated as Section 40 CFR Parts 51 and 93) are designed to ensure that federal actions do not cause or contribute to air quality violations in areas that do not meet the national ambient air quality standards. The 2 rules include transportation conformity, which applies to transportation plans, programs, and projects, and general conformity, which applies to all other nontransportation-related projects.

The general, conformity regulation requires that federal agencies sponsoring nontransportation-related activities show that the emissions associated with those activities conform to state implementation plans (SIPs) if emissions meet specific criteria. First, the emissions must occur in areas designated as nonattainment areas for one or more of the federal ambient air quality standards. Second, those emissions must exceed certain *de minimis* threshold levels.

The proposed wetland restoration is subject to a federal conformity analysis under the general conformity rule. Currently, the SFBAAB, which includes Marin County, where the proposed wetland restoration is located, is classified as a moderate federal nonattainment area for ozone. Ozone is an indirectly generated pollutant that results when the ozone precursors NOx and reactive organic gases (ROG) form in the atmosphere in the presence of sunlight. Because ozone is not a directly emitted pollutant, EPA has, in its general conformity regulations, set de minimis levels for ozone precursors rather than for ozone. From a conformity standpoint, areas classified as moderate ozone nonattainment areas are exempt from conformity if emissions of ROG are less than 50 tons per year and emissions of NOx are less than 100 tons per year.

Existing Air Quality Conditions

The existing air quality conditions in the proposed expansion area are characterized by air quality monitoring data collected in the region. PM10, CO, and ozone concentrations are measured at several north Bay monitoring stations. Recent monitoring data are presented in table 4-18. The closest monitoring station is located in San Rafael. A description of the major pollutants found in the expansion area is provided below.

Ozone

Ozone is a respiratory irritant and an oxidant that increases susceptibility to respiratory infections and can cause substantial damage to vegetation and other materials. Ozone is a severe eye, nose, and throat irritant. Ozone also attacks synthetic rubber, textiles, plants, and other materials. Ozone causes extensive damage to plants by leaf discoloration and cell damage.

State and federal standards for ozone have been set for a 1-hour averaging time. The state 1-hour ozone standard is 0.09 ppm, not to be exceeded more than 3 days in 3 years. The federal 1-hour ozone standard is 0.12 ppm, not to be exceeded more than 3 times in any 3-year period. The monitoring data has shown few instances where exceedances of the ozone state standard occurred during the 3 most recent years of available data.

Ozone is not emitted directly into the air, but is formed by a photochemical reaction in the atmosphere. Ozone precursors, which include ROG and oxides of nitrogen (NOx), react in the atmosphere in the presence of sunlight to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem. The ozone precursors, ROG and NOx, are emitted by mobile sources and by stationary combustion equipment.

Carbon Monoxide

Carbon monoxide is essentially inert to plants and materials but can have significant effects on human health. Carbon monoxide is a public health concern because it combines readily with hemoglobin and thus reduces the amount of oxygen transported in the bloodstream. Effects on humans range from slight headaches and nausea to death.

State and federal CO standards have been set for both 1-hour and 8-hour averaging times. The state 1-hour standard is 20 parts per million (ppm) by volume, and the federal 1-hour standard is 35 ppm. Both state and federal standards are 9 ppm for the 8-hour averaging period. The monitoring data shows no recorded violations of the CO standards during the 3 most recent years of available data.

Table 4-18. Ambient Air Quality Monitoring Data Recorded at San Rafael Monitoring Station

Pollutant Standards	1998	1999	2000
Ozone (O_3)			
Maximum 1-hour concentration (ppm)	0.074	0.102	0.071
No. Days Standard Exceeded			
NAAQS (1-hour) > 0.12 ppm	0	0	0
CAAQS (1-hour) > 0.09 ppm	0	2	0
Carbon Monoxide (CO)			
Maximum 8-hour concentration (ppm)	3.3	2.9	2.3
Maximum 1-hour concentration (ppm)	5.9	5.6	4.2
No. Days Standard Exceeded			
NAAQS (8-hour) ≥ 9.0 ppm	0	0	0
NAAQS (1-hour) ≥ 35 ppm	0	0	0
CAAQS (8-hour) ≥ 9.0 ppm	0	0	0
CAAQS (1-hour) ≥ 20 ppm	0	0	0
Particulate Matter (PM_{10})			
Maximum 24-hour concentration ($\mu g/m^3$)	52.4	75.6	39.5
2nd highest 24-hour concentration ($\mu g/m^3$)	39.8	64.4	38.7
Average arithmetic mean concentration ($\mu g/m^3$)	20.1	22.0	19.5
Average geometric mean concentration ($\mu g/m^3$)	18.7	19.5	18.1
No. Days Standard Exceeded			
NAAQS (24-hour) > 50 $\mu g/m^3$	0	0	0
CAAQS (24-hour) > 150 $\mu g/m^3$ [1]	1	2	0

[1] Recorded every six days.

Source: California Air Resources Board 2002; Environmental Protection Agency 2002

Motor vehicles are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light wind combine with the formation of ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures.

Particulates

Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Particulates can damage human health and retard plant growth. Particulates also reduce visibility, soil buildings and other materials, and corrode materials. The primary particulate of concern in the expansion area is PM10.

The state PM10 standards are 50 micrograms per cubic meter as a 24-hour average and 30 micrograms per cubic meter as an annual geometric mean. The federal PM10 standards are 150 micrograms per cubic meter as a 24-hour average and 50 micrograms per cubic meter as an annual arithmetic mean. The monitoring data shows a few exceedances of the state PM10 24-hour standard during the 3 most recent years of available data.

PM10 emissions are generated by a wide variety of sources, including agricultural activities, industrial emissions, dust suspended by vehicle traffic, and secondary aerosols formed by reactions in the atmosphere.

Environmental Consequences and Mitigation Measures

Approach and Methods

The approach used in evaluation of air quality impacts is generally qualitative and follows requirements outlined by the BAAQMD. The BAAQMD's approach to analysis of construction impacts is to emphasize implementation of effective and comprehensive control measures rather than detailed quantification of emissions (Bay Area Air Quality Management District 1999). However, because of the requirement to prepare a general conformity analysis as required by EPA and BAAQMD, a quantitative evaluation of ozone precursors was conducted.

Impact Mechanisms

Impacts analyzed in this document include onsite construction emissions and emissions due to visitor or maintenance activity after the restoration activity is completed. Emissions associated with transport of dredged material to the site are not included as they are presumed to be analyzed in the environmental compliance documentation associated with dredging projects that may propose to use BMKV as a dredged material placement location.

Construction of the proposed wetland restoration may generate significant air emissions. Terrestrial construction-related emissions are generally short term but may still cause adverse air quality impacts. Fine particulate matter (PM10) is the pollutant of greatest concern with respect to terrestrial construction activities. PM10 emissions can result from a variety of construction activities, including excavation, grading, demolition, vehicle travel on paved and unpaved roads, and emission of vehicle and equipment exhaust. Terrestrial construction-related emissions of PM10 can vary greatly depending on the level of activity, the specific operations taking place, the equipment being operated, local soils, weather conditions and other factors. Construction-related emissions can cause substantial increases in localized concentrations of PM10. Particulate emissions from construction activities can lead to adverse health effects, as well as nuisance concerns such as reduced visibility and soiling of exposed surfaces (Bay Area Air Quality Management District 1999).

In addition, PM10 emissions could be generated from the dredged material as it dries, prior to breaching of the levees.

Terrestrial construction equipment emits CO and ozone precursors. However, these emissions are included in the emission inventory that is the basis for the regional air quality plans. Terrestrial construction equipment activities are not expected to impede attainment or maintenance of ozone and CO standards in the Bay Area (Bay Area Air Quality Management District 1999). Impacts on CO are assumed to be less than significant and are not evaluated further. Ozone precursors are evaluated in the general conformity analysis.

Use of diesel pumps and associated equipment to off-load and pump dredged material from offshore into the expansion site could also result in the emission of ozone precursors.

At full function, the proposed BMKV expansion would generate air emissions related to visitor use and maintenance activities. Because visitor use and periodic maintenance activities would be limited, impacts on air emissions from visitor use and maintenance activities are considered less than significant.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding air quality, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- allow uncontrolled emissions of PM10; or
- result in annual emissions exceeding EPA and BAAQMD conformity thresholds (50 tons ROG per year or 100 tons NOx per year).

Impacts and Mitigation Measures of No-Action Alternative

Under the No-Action Alternative, the expansion area would not be used as a wetland restoration site and existing uses are expected to continue. Because no changes in activities are expected under the No-Action Alternative, no change in PM10, CO, or ozone precursors would occur.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact A-1: Construction-Related Emissions of PM10 from Terrestrial Construction Equipment

As described above under *Impact Mechanisms*, implementation of the proposed BMKV expansion would result in PM10 emissions, resulting from grading and other ground-disturbing activities required for site preparation, dredged material placement, and other restoration activities. This impact would be considered significant. To reduce this impact to a less-than-significant level, the following mitigation measure would be implemented:

Mitigation Measure A-1: Control PM10 Emissions in Accordance with BAAQMD Standards.

Basic Control Measures – The following controls should be implemented at all construction sites.

- Water all active construction areas at least twice daily.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least 2 feet of freeboard.
- Pave, apply water 3 times daily, or apply (nontoxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites.

- Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites.
- Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.

Enhanced Control Measures – The following measures should be implemented at construction sites greater than 4 acres in area.

- Hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more).
- Enclose, cover, water twice daily, or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.).
- Limit traffic speeds on unpaved roads to 15 mph.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways.
- Replant vegetation in disturbed areas as quickly as possible.

Optional Control Measures – The following control measures will be considered for use at construction sites that are large in area, located near sensitive receptors, or which may warrant additional emissions reductions for any other reason.

- Install wheel washers for all exiting trucks, or wash off the tires or tracks of all trucks and equipment leaving the site.
- Install wind breaks, or plant trees/vegetative wind breaks at windward side(s) of construction areas.
- Suspend excavation and grading activity when winds (instantaneous gusts) exceed 25 mph.
- Limit the area subject to excavation, grading, and other construction activity at any one time.

Impact A-2: Construction-Related Emissions of Ozone Precursors from Terrestrial Equipment and Equipment Associated with Offloading of Dredged Material

An emissions estimate for construction activity was developed to analyze the general conformity of the proposed BMKV expansion. This conformity analysis is presented in appendix E. The estimate for terrestrial construction activity (other than activity associated with off-loading of dredged material) identifies that the alternatives could generate emissions of up to 1.7 tons per year of ROG and 25.2 tons per year of NOx during the onshore construction activity.

Emission estimates were also developed for equipment associated with off-loading of dredged material. Dredged material would arrive by barge at the

offshore off-loading facility. Off-loading of dredged material would involve the use of supporting marine vessels and other equipment, as well as hydraulic pumping of the dredged material to the HWRP sites, including the BMKV site. Several options for pumping are being considered, including use of electrically driven pumps, use of diesel-fired pumps, and combinations of the two. Electrically driven pumps would not generate any site-related emissions by themselves. Diesel pumps, marine vessel engines, and associated equipment (like generators) would generate NOx in addition to other priority pollutants. For this analysis, only emissions for NOx were estimated as an indicator of pumping equipment that may pose a regulatory concern. The emissions estimate includes off-loader pumps, generators, a work tug at the off-loader facility, a crew boat, a loader, and several hydracranes and bulldozers that would assist with the pumping activity.

Three different scenarios reflecting different levels of annual dredged material (low—0.5 million cubic yards [mcy], medium—1.25 mcy, and high—3.5 mcy) were evaluated to reflect a range of possible dredged material delivery volumes to the BMKV site. The emissions estimate is summarized in table 4-19 and presented in appendix E. The following 5 configurations were evaluated.

- Diesel Unmitigated – The unmitigated case assumed all equipment to be diesel-powered with engines typical of existing equipment.
- Diesel Mitigated – The mitigated case assumed that emission reduction technology would be implemented on the main engines of the off-loader and booster pump only. Emission reduction was based on the use of selective catalytic reduction (SCR) to the engines.
- Electrified – This case assumed that the off-loader and booster pumps are electric.
- Electrified Booster/Diesel Off-loader – This case was a hybrid of the unmitigated case and the electrified case.
- Electrified Booster/Diesel Off-loader (mitigated) – This case was a hybrid of the mitigated case and the electrified case.

In the diesel unmitigated case, the emissions estimate in the medium and high scenarios would be above the conformity threshold of 100 tons. In the diesel mitigated case, only the emissions associated with the high scenario would exceed the threshold. NOx emissions in the electrified case were below the threshold for all three scenarios. Emissions in the hybrid unmitigated case were above the threshold only for the high scenario. NOx emissions in the hybrid mitigated case were below the threshold for all 3 scenarios.

Depending on the choice of equipment and power source (diesel or electric) and upon the amount of dredged material pumped per year, NOx emissions could exceed the conformity threshold and result in a significant impact on air quality. To reduce this impact to a less-than-significant level, Mitigation Measure A-2 would be implemented

Mitigation Measure A-2: Control and/or Offset NOx Emissions Associated with Off-loading Dredged Material.

One or more of the following options will be implemented in order to mitigate NOx emissions to a less-than-significant level.

- **Option 1** – Use electric power for the off-loader and booster pumps.
- **Option 2** – Use SCR for the diesel off-loader and booster-pump engines, and limit annual pumping activity to a level that will result in emissions below the conformity thresholds.
- **Option 3** – Use electric power for the booster-pump engines and SCR for the diesel off-loader pump engine
- **Option 4** – Use electric power for the booster-pump engines, and limit annual pumping activity to a level that will result in emissions below the conformity thresholds.
- **Option 5** – Use diesel pumps, and limit annual pumping activity to a level that will result in emissions below the conformity thresholds. Based on the emissions estimate prepared, this annual volume limit would be approximately 1 mcy/year.
- **Option 6** – Pursue an engine retrofit program for locally operated tugboats in order to compensate for potential exceedance(s) of the conformity levels.
- **Option 7** – Purchase offsetting mitigation credits from other regulated entities.

With implementation of this mitigation, this impact to air quality is considered less than significant.

Impacts Unique to Alternative 3

Impact A-3: Operational Emissions of a Relief Pump

Operation of relief pump(s)at the pump station for relief of high water (above 1.5' NGVD) in the BMK south lagoon could result in emissions of priority pollutants. The specific design of the pump(s) has not been conducted, thus it is unknown if they would be electric or diesel and what their emission characteristics would be. However, assuming they are diesel (or that at least a backup pump is diesel), operation could result in release of emissions of priority pollutants. This pump would only operate sporadically when necessary to provide relief of high-water levels in the south lagoon. Since the need for operation is limited to periodic storm events, it is unlikely that the pump would be operated a sufficient number of hours to exceed the annual emissions thresholds listed in the significance criteria, and thus this impact is considered to be less than significant. If this alternative were selected, the project sponsors would consult with BAAQMD to determine if the relief pump required a permit and what best management practices for the pump would be appropriate.

Table 4-19. Off-loading Activity NOx Emissions Summary, BMKV Expansion (annual tons)

Scenario (Annual mcy)	Low (0.5 mcy)	Medium (1.25 mcy)	High (3.5 mcy)
Diesel Unmitigated	68.9	138.4	346.8
Diesel Mitigated	40.4	66.7	145.6
Electrified	6.8	17.0	47.8
Diesel Off-loader (unmitigated)/ Elec. Booster	35.6	70.1	173.3
Diesel Off-loader (mitigated)/ Elec. Booster	23.9	40.7	91.2

BAAQMD Conformity Threshold for NOx = 100 tons/year

Source: Moffatt, Nichol 2002

Noise

Affected Environment

This section evaluates noise impacts associated with the proposed BMKV expansion. Construction noise would be the only notable source of noise associated with restoration. Use or maintenance of the restoration site would not generate significant noise.

Data Sources and Terminology

The *Hamilton Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998) provided the basis for this discussion.

The following are brief definitions of acoustical terminology used in the analysis of noise impacts.

Sound – A vibratory disturbance created by a vibrating object which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism such as the human ear or a microphone.

Noise – Sound that is loud, unpleasant, unexpected, or otherwise undesirable.

Ambient Noise – The composite of noise from all sources near and far in a given environment exclusive of particular noise sources to be measured.

Decibel, dB – A unitless measure of sound on a logarithmic scale which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-Pascals.

A-Weighted Decibel, dBA – An overall frequency-weighted sound level in decibels which approximates the frequency response of the human ear.

Equivalent Sound Level, Leq – The equivalent steady state sound or vibration level which in a stated period of time would contain the same acoustical or vibration energy.

Percentile Exceeded Sound Level, Lxx – The sound level exceeded a specified percentage of the measurement duration. For L_{10} is the sound level exceeded 10 percent of the time and L_{90} is the sound level exceeded 90 percent of the time.

Day-Night Level, Ldn –The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10 p.m. to 7 a.m.

In general, human sound perception is such that a change in sound level of 3 dB is generally perceived as being just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

Noise-Sensitive Land Uses in the Expansion Area

Noise-sensitive land uses are generally defined as locations where people reside or where the presence of unwanted sound could adversely effect the use of the land. Noise-sensitive land uses typically include residences, hospitals, schools, guest lodging, libraries, and certain types of recreational uses. The existing and potential future noise-sensitive uses in the expansion area include the following.

- The BMK residential development, located north of the restoration site (construction activity on or adjacent to the south lagoon levee on the northern perimeter of BMKV could occur within 150 to 300 feet from the nearest residences to the south lagoon levee; most construction would occur further from the BMK residential community on other portions of BMKV)
- The Hamilton residential development, located south of the restoration site (construction activity along the southern HAAF–BMKV perimeter would be within about 1,250 feet, at the closest, to this development)
- Public uses of the future Bay Trail

Existing Noise Conditions

Ambient sound levels associated with noise-sensitive land uses in the vicinity of the expansion site vary depending on the proximity of major existing noise sources such as traffic, aircraft, and industrial uses. Ambient sound levels in similar suburban/rural settings are typically in the range of 40 to 60 dBA. Noise levels were measured in 1991as part of the 1993 EIR prepared for the prior proposed development at BMKV (see table 4-20). Development in the BMK community or on the BMKV property itself has not changed since 1991, so these measurements are felt to reasonably represent the ambient noise levels present at the site.

Table 4-20. Measured Noise Levels at Selected Locations in the Expansion Area

Location	Duration (hours)	Leq (dBA)	Lmax (dBA)
Center of BMKV	0.25	48	62
Eastern Tip of BMK III	0.25	47	58
Entrance to Site (15 m from BMK Blvd.)	0.30	55	74
Southern property boundary (HAAF/BMKV)	24	52	80

Source: ESA 1993

Noise Standards and Regulation

Various federal, state, and local agencies have developed guidelines for evaluating land use compatibility under different sound-level ranges. These guidelines are summarized below:

Federal Guidelines

The federal Noise Control Act of 1972 established a requirement that all federal agencies administer their programs to promote an environment free of noise that jeopardizes public health or welfare. The EPA was given the responsibility for:

- providing information to the public regarding identifiable effects of noise on public health or welfare,
- publishing information on the levels of environmental noise that will protect public health and welfare within an adequate margin of safety,
- coordinating federal research and activities related to noise control, and
- establishing federal noise-emission standards for selected products distributed in interstate commerce.

The EPA identified indoor and outdoor noise limits to protect against effects on public health and welfare. Outdoor limits of 55 dB-Ldn and indoor limits of 45 dB-Ldn are identified as desirable to protect against speech interference and sleep disturbance for residential areas and areas with educational and healthcare facilities.

The U.S. Department of Housing and Urban Development has established guidelines for evaluating noise impacts on residential projects. Sites are generally considered acceptable if they are exposed to outdoor noise levels of 65 dB-Ldn or less, normally unacceptable if they are exposed to levels of 65–75 dB-Ldn, and unacceptable if exposed to levels of 75 dB-Ldn or greater.

State Guidelines

In 1987, the California Department of Health Services published guidelines for the noise elements of local general plans. These guidelines include a sound level/land use compatibility chart that categorizes various outdoor Ldn ranges by land use. These guidelines identify the normally acceptable range for low-density residential uses as less than 65 dB and conditionally acceptable levels as 55–70 dB.

Local Guidelines

The Marin County General Plan (1994) established noise level performance standards for stationary sources for areas within the county. Table 4-21 summarizes the county's standards. However, it should be noted that there would be no stationary noise sources associated with the restoration after construction is completed. During construction, there would be mobile sources associated with vehicles but no fixed stationary sources other than the electrical off-loading pumps which would be located in San Pablo Bay, far from any sensitive receptor.

Table 4-21. Allowable Noise Exposure from Stationary Noise Sources in Marin County

	Daytime (7:00 a.m. to 10:00 p.m.)	Nighttime (10:00 p.m. to 7:00 a.m.)
Hourly dB (L_{eq})	50	45
Maximum Level	70	65
Maximum level (Impulsive Noise)	65	60

Source: Marin Countywide Plan, 1994

Marin Countywide Plan policy N-2.4 requires measures to be taken to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity. Under Program N-2.4a, the Marin County Community Development Department reserves the right to set hours for construction-related activities that involve the use of machinery, power tools, or hammering. The Marin Countywide Plan identifies, in general, that residential areas should not be exposed to sound levels greater than 60 dBA. However, this guidance is primarily concerned with the location of new development, rather than temporary construction noise.

The City of Novato's General Plan (2000) has established the following noise level performance standards for areas within the city. Table 4-22 summarizes the

city's standards. The city's Noise Ordinance prohibits noise between the hours of 10:00 p.m. and 6:00 a.m. The BMKV site is not within the City of Novato, but the Hamilton residential development is within the city limits.

Table 4-22. City of Novato Noise and Land Use Compatibility Standards

Land Use Category	Maximum allowable noise level
Residential Development	Up to 60 dB
Transient Lodging: Motel and Hotel	Up to 60 dB
School, Library, Church, Hospital and Nursing Home	Up to 60 dB
Auditorium, Concert Hall, Amphitheater	Up to 70 dB
Sports Arena, Outdoor Spectator Sports	Up to 70 dB
Playgrounds, Neighborhood Parks, Open Space	Up to 65 dB
Golf Course, Cemetery	Up to 70 dB
Office Building, Business, Commercial & Professional	Up to 70 dB
Industrial, Manufacturing, Utilities	Up to 70 dB

Source: City of Novato General Plan 2000

Environmental Consequences and Mitigation Measures

Approach and Methods

Noise impacts were evaluated by comparison of anticipated noise levels with reference noise levels developed by EPA, the distances to sensitive noise receptors, and local noise guidelines. Noise levels were measured in A-weighted decibels (dBA), a composite frequency-weighting scheme that approximates the way the human ear responds to sound levels.

Impact Mechanisms

Construction activities associated with restoration could intermittently generate elevated noise levels on and adjacent to construction sites within the expansion area. Offshore pile-driving activity associated with potential off-loader and booster-pump platforms is discussed separately from onshore construction activity.

Onshore construction activities associated with the restoration would include demolition, grading and earthmoving activities, hauling materials, building

structures, and pumping activities. Existing noise-sensitive land uses located in the vicinity of the construction activity could be exposed to construction noise.

Table 4-23 summarizes typical noise levels produced by onshore construction equipment commonly used for development of wetland restoration sites. As indicated, equipment involved in construction is expected to generate noise levels ranging from 76 dB to 89 dB at a distance of 50 feet. Noise produced by construction equipment would be reduced at a rate of about 6 dB per doubling of distance.

Table 4-23. Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA) 50 ft from Source
Backhoe	80
Compactor	82
Crane, Derrick	88
Crane, Mobile	83
Dozer	85
Grader	85
Loader	85
Paver	89
Pump	76
Scraper	89
Truck	88

Source: U.S. Department of Transportation, Federal Transit Administration1995.

A reasonable worst-case assumption for onshore construction is that the 3 loudest pieces of equipment would operate simultaneously and continuously over at least a 1-hour period. The combined sound level of 3 of the loudest pieces of equipment listed in table 4-23 (paver, scraper, and truck) is 93-dBA measured at 50 feet from the source. Table 4-24, which assumes this combined source level, summarizes predicted noise levels at various distances from an active construction site. These estimations of noise levels take into account distance attenuation, attenuation from molecular absorption, and anomalous excess attenuation (Hoover 1996). The results in table 4-24 indicate that the resultant worst-case sound levels of greater than 60 dBA could occur within about 1,500 feet. Operation of a single piece of equipment, such as a scraper, could result in sound levels greater than 60 dBA within about 1,000 feet.

Table 4-24. Estimated Onshore Construction Noise in the Vicinity of an Active Construction Site

Distance Attenuation	Sound Level at Receptor (dBA)	
Distance to Receptor (feet)	Combined Equipment	Single Piece of Equipment (e.g. Scraper)
50	93	89
100	87	83
200	81	77
500	72	68
600	71	66
800	68	64
1,000	65	61
1,500	61	57
2,000	58	54
2,500	55	51
3,000	52	48
4,000	48	44
5,280	44	40
7,500	37	33

The following assumptions were used:

Basic sound level drop-off rate:	6.0	dB per doubling of distance
Molecular absorption coefficient:	0.7	dB per 1,000 feet
Anomalous excess attenuation:	1.0	dB per 1,000 feet
Reference Sound Level (Combined)	93	dBA
Reference Sound Level (Single)	89	dBA
Distance for Reference Sound Level:	50	Feet

Notes:

This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Pile-driving may be conducted offshore for the off-loader and booster-pump platforms. Approximately thirty 36-inch diameter piles may be driven over a 1-month period using a pile-driving hammer with a power of approximately 110 to 220 kJ. The off-loading facility would be located approximately 30,000 feet from the expansion restoration site, at approximately the –24- to –28-foot MLLW. The booster-pump platform would be located offshore between the off-loading facility and the shoreline. Impact pile drivers can have typical noise

levels in excess of 100 dBA at 50 feet, depending on size (U.S. Department of Transportation, Federal Transit Administration 1995).

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding noise, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- increase noise levels to greater than 60 dBA in residential areas adjacent to the site, or
- increase noise levels by 3 dBA in areas where noise levels already exceed 60 dBA.

Impacts and Mitigation Measures of No-Action Alternative

Under the No-Action Alternative, construction of the proposed BMKV expansion would not occur, and no new noise sources would be created.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact N-1: Potential Increases in Traffic Noise Levels

Implementation of the proposed BMKV expansion would result in increases in traffic associated with construction and operation of the restoration site. Because materials for levee construction are available onsite, traffic generated during the construction phase would consist primarily of workers commuting to the site. The low number of these daily trips is not expected to affect noise conditions in the area crossed by the proposed access easement. Therefore, the impact on sensitive noise receptors as a result of increased traffic during the construction is considered less than significant.

After the construction of the BMKV expansion is completed, traffic on the site would consist of trips made for maintenance and monitoring purposes in addition to recreational users. Trips made for maintenance and monitoring purposes would be infrequent and would not affect post-construction noise levels. Although no formal recreation use plan has been developed for the site, the number of trips made for recreational purposes is not expected to substantially increase. Therefore, the impact on sensitive noise receptors as a result of increased traffic during operation is considered less than significant.

Impact N-2: Temporary Increases in Noise Levels to more than 60 dBA during Onshore Construction

As described above, implementation of the proposed BMKV expansion could result in temporary noise levels exceeding 60 dBA at distances up to 1,500 feet due to combined equipment activity and at distances up to 1,000 feet from single equipment activity associated with grading and other ground disturbing construction activities. Most of the BMKV site is below grade because of subsidence; restoration construction activity within the center of the site is likely to be below the elevation of the perimeter levees. However, construction activity on the northern or southern levees could be on a similar elevation to nearby residences in the BMK and Hamilton residential areas.

Sensitive noise receptors during construction include residences in these 2 areas. Construction activity could occur in the range of 150–300 feet from the nearest BMK residence when working on or near the south lagoon levee and within 1,250 feet from the nearest Hamilton residences when working on the HAAF–BMKV levee. Due to the distance to the Hamilton residential development and the existence of the New Hamilton Partnership levee (elevation 8 to 12 feet NGVD) on the western side of the former airstrip, no significant impacts are expected for the Hamilton residences. Although the impact to some of the nearest BMK residences would be temporary, this impact is considered significant. To reduce this impact to a less-than-significant level, the following mitigation measure would be implemented:

Mitigation Measure N-1: Employ Noise-Reducing Construction Practices.

To reduce noise levels to the maximum extent practicable, the wetland construction contractor will employ the following noise-reducing construction practices.

- During construction phases, the contractor will ensure that construction is performed in accordance with applicable City and County noise standards. No noise generating construction or repair work within 1,000 feet of residences will be performed between the hours of 10:00 p.m. and 7:00 a.m. on any weekday, Sunday, or legal holiday.
- During construction phases, earthmoving within 300 feet of an occupied residence will only be performed during normal daylight hours (8:00 a.m. to 5:00 p.m.), Monday through Saturday, wherever feasible.
- Mufflers should be kept operable and effective on all construction equipment, generators, and vehicles. All internal combustion engines must be operated with exhaust and intake silencers. Wherever possible, noise-generating construction equipment should be shielded from nearby residences by noise-attenuating buffers such as structures or truck trailers.
- Prior to construction within 1,000 feet of residences, written notice should be provided to potentially affected residences identifying the type, duration, and frequency of construction activities. Notification materials will also identify

a mechanism for residents to register complaints if construction noise levels are overly intrusive or construction occurs outside the required hours.

- Construction staging area(s) and stockpile areas will be located at least 1,000 feet from occupied residences, or contractors will be required to provide appropriate noise-reducing engine-housing enclosures. Equipment warm-up areas, water tanks, and storage areas should be located in the established staging area or in other portions of the expansion site more than 1,000 feet from existing residences as feasible.

- Throughout the construction period, the contractor will implement appropriate additional noise mitigation measures, including, but not limited to, changing the location of stationary construction equipment, shutting off idling equipment, rescheduling construction activity, or installing temporary barriers around stationary construction noise sources at the request of the City or County.

Impact N-3: Temporary Increase in Noise Levels due to Offshore Pile-Driving

Pile-driving may be conducted offshore as part of construction of the off-loading facility and the booster-pump platform. The off-loading facility would be located more than 1 mile from the nearest shoreline and any associated residences. Assuming the pile-driving equipment resulted in an impulse noise level of 101 dBA at 50 feet, the noise level of pile driving would attenuate to less than 60 dBA within 4,800 feet of the pile-driving location, which is not near any residential areas. This impact is considered less than significant. Impacts to marine mammals and sensitive fish species is discussed separately above in the *Biological Resources* section of this chapter.

Impacts and Mitigation Measures Unique to Alternative 1 and Revised Alternative 2

Impact N-4: Increased Noise from Use of Hydraulic Off-Loaders and Supplemental Booster Pumps

Under Alternative 1, electric-powered or diesel-powered hydraulic off-loaders would be located approximately d 24,000 feet (4.5 miles), respectively, offshore. The equipment would not contribute significantly to ambient noise levels onshore because of their relatively low noise level during operation and due to their relative distant location from sensitive receptors onshore. Similarly, electric-powered or diesel-powered supplemental booster pumps, which would also be located offshore, would not contribute significant increases in the ambient noise levels onshore. Because of the distance between the off-loaders and sensitive noise receptors, noise levels at sensitive receptors would be fall below desirable

limits. The impact on sensitive noise receptors as a result of off-loading equipment during construction is considered less than significant.

Impacts Unique to Alternative 3

Impact N-5: Increased Noise from Use of Relief Pump(s)

Under Alternative 3, an electric-powered or diesel-powered pump or pumps would be located along the levee east of the existing BMK south lagoon lock at the pump station (see figure 3-8). The specific size and type of equipment for these pumps has not been determined. The purpose of a pump or pumps would be to accommodate the existing BMK CSD easement for overflow when the lagoon reaches an elevation of 1.5 feet NGVD. Alternative 3, unlike Alternative 1 and Revised Alternative 2, does not contain a swale to receive lagoon overflow, and thus a pump would be necessary to take the overflow. The levee along the east side of the lagoon is relatively close to the existing houses that are at the end of Bel Marin Keys Boulevard and Bahama Reef. The pumps would only be expected to operate during storm events when the south lagoon could not be drained due to high stage in Novato Creek and thus noise impacts would expected to be temporary in nature. As this facility has not been designed, it is unknown what kind of shielding would be placed around the pumps or what kind of structure the pump station would be. As such, this impact is considered a potentially significant though temporary impact, when the pumps actually are operated. If Alternative 3 were selected, the following mitigation is recommended to reduce this impact to less than significant.

Mitigation Measure N-2: Employ Noise-Reducing Design if the Pump Station in Alternative 3 Is Built.
To reduce noise levels associated with pump operation, an engineering noise assessment would be conducted to determine the appropriate design features to reduce noise impacts to nearby residences. These design features may include, but are not limited to: pump size; pump station building construction; localized pump engine shielding; use of electrical pumps; and/or positioning of the pumps below the levee crest on the east side (if feasible).

Cultural Resources

Introduction

An archaeological and architectural investigation was conducted in compliance with the requirements of CEQA, NEPA, and Section 106 of the National Historic Preservation Act (NHPA) for the proposed BMKV expansion. This section represents the results of the cultural resources investigation.

Data Sources

A records search conducted at the Northwest Information Center of the California Historical Resources Information System resulted in the identification of several prehistoric archaeological sites that have been recorded within a 0.5-mile radius of the expansion area (Nelson 1909). However, no prehistoric archaeological sites have been identified in the proposed expansion area. Previous studies within the area of potential effect (APE) (Archaeological Consulting and Research Services 1979, Flynn 1978, Shannon 1992) did not result in the identification of prehistoric resources. There are many previously recorded prehistoric sites close to the expansion area, all of which have been found on the low terraces, at a slight elevation above sea level (Nelson 1909). In 1909, Nelson reported on several sites located north and south of the expansion area. These sites are primarily prehistoric occupation sites and locations where the native population procured food and other resources. Shannon (1992) identified several historic and architectural resources within the expansion area and provided some indication for sensitivity.

A letter was sent to the Native American Heritage Commission (NAHC) requesting that they consult their sacred lands file and send a list of individuals and organizations that may have knowledge of properties of cultural or religious importance to Native Americans in the expansion area. The search of the sacred lands file revealed no Native American cultural properties within the expansion area, and a letter was sent to each individual and organization identified on the NAHC list. To date, no responses have been received.

In an effort to identify important historic people, events, and architectural trends that may have been associated with the project area, a Jones & Stokes historian conducted archival research at the following locations.

- County of Marin Assessor's Office
- County of Marin Recorder's Office
- California State Library, Sacramento
- Division of Mines and Geology Library, Sacramento

- California State Lands Commission
- Marin County Civic Center Library
- Novato History Museum

Previous reports that were consulted include the following.

- *Hamilton Wetland Restoration Plan Final Environmental Impact Report/Environmental Impact Statement* (Jones & Stokes 1998);
- National Register of Historic Places Evaluation, Hamilton Army Air Field Historic District, Marin County, California (PAR Environmental Services, Inc. 1993);
- *Bel Marin Keys V Final Environmental Impact Report/Environmental Impact Statement* (Environmental Science Associates 1993);
- Archaeological Impact Evaluation of Two Non-Contiguous Parcels of Land Near Ignacio, Marin County (Archaeological Resource Service 1978).

Field Surveys

Archaeology

A Jones & Stokes archaeologist conducted pedestrian field surveys at the expansion site on January 17 and 18, 2002, February 25, 2002, and August 1 and 2, 2002. The multiple surveys were conducted in a manner that allowed portions of the expansion site to be viewed. During the surveys, the levees around the circumference of the property were walked in a linear manner. Areas around historic structures and areas of suspected historic activity were investigated using intensive transects spaced no farther than 10 meters apart. No other areas appeared to have sensitivity for the presence of archaeological resources.

The proposed Bay Trail alignment in Alternative 1, the Pacheco Pond outlet channel, and the Conservancy-owned parcel north of Bel Marin Keys boulevard were surveyed on August 1 and 2, 2002. A pedestrian survey was conducted from the base of Ammo Hill to Bel Marin Keys Boulevard along the proposed Bay Trail route in Alternative 1. Approximately 50% of this area was found to be covered with dense grasses and dense marsh vegetation, and there was low visibility throughout the area in general. The area appears to be one of low sensitivity for the presence of archaeological remains. The Pacheco Pond outlet channel on the northern side of Bel Marin Keys Boulevard, was covered in heavy vegetation, including impenetrable blackberry bushes, and the visibility in this area was generally low.

Built Environment

A Jones & Stokes architectural historian conducted field surveys of the project site on January 9, 2002, and August 1, 2002. The survey area included the BMKV parcel, the SLC parcel, the Bay Trail route proposed under Alternative 1, the Pacheco Pond outlet channel, and the Conservancy owned parcel north of Bel Marin Keys Boulevard. As part of the field process, buildings and structures in the APE were inspected and photographed, and notes were gathered.

Determination of Significance of Cultural Resources

Historical resources are defined as buildings, sites, structures, objects, or districts, each of which may have historical, architectural, archaeological, cultural, or scientific significance.

Prior to the assessment of effects or the development of mitigation measures, the significance of cultural resources must be determined. The steps that are normally taken in a cultural resources investigation for CEQA compliance are:

- identify potential historical resources,
- evaluate the eligibility of historical resources,
- evaluate the effects of a project on all eligible historical resources.

Because the federal trigger for NEPA also triggers Section 106 of NHPA (36 CFR et. seq.), the 2 compliance processes can be coordinated.

Section 106 of the NHPA requires that, before beginning any undertaking, a federal agency must take into account the effects of the undertaking on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on these actions. The Section 106 process has 6 basic steps.

- Initiate consultation and public involvement
- Identify and evaluate historic properties
- Assess effects of the project on historic properties
- Consult with the State Historic Preservation Officer (SHPO) regarding adverse effects on historic properties, resulting in a memorandum of agreement (MOA)
- Submit the MOA to the ACHP
- Proceed in accordance with the MOA

The assessment of impacts presented in this section applies the Criteria of Effect and Adverse Effect, as defined by the NHPA. Because these criteria are

consistent with the criteria for determining impacts for both CEQA and NEPA, this section will be used to document the effects of the proposed wetland restoration for the purpose of CEQA, NEPA, and Section 106. Specific regulations regarding compliance with Section 106 state that, although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency (in this case, the Corps) is ultimately responsible for ensuring that the Section 106 process is completed according to statute.

Cultural Resource Significance Criteria

CEQA guidelines define 3 ways that a property can qualify as a significant historical resource for the purposes of CEQA review.

- If the resource is listed in or determined eligible for listing in the California Register of Historical Resources (CRHR)
- If the resource is included in a local register of historical resources, as defined in section 5020.1(k) of the Public Resources Code, or identified as significant in a historical resource survey meeting the requirements of section 5024.1(g) of the Public Resources Code unless the preponderance of evidence demonstrates that it is not historically or culturally significant
- If the lead agency determines the resource to be significant as supported by substantial evidence in light of the whole record (California Code of Regulations, Title 14, Division 6, Chapter 3, section 15064.5)

For a historical resource to be eligible for listing in the CRHR, it must be significant at the local, state, or national level under 1 or more of the following 4 criteria.

- It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States.
- It is associated with the lives of persons important to local, California, or national history.
- It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master, or possesses high artistic values.
- It has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.

Historical resources automatically listed in the CRHR include those historic properties listed in, or formally determined eligible for listing in, the National Register of Historic Places (NRHP) (PRC section 5024.1).

Because the proposed wetland restoration must comply with NEPA and Section 106 of the NHPA, federal significance criteria are also applied in the following

analysis. For federal projects, cultural resource significance is evaluated in terms of eligibility for listing in the NRHP. NRHP criteria for eligibility are defined as follows:

The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and that:

- are associated with events that have made a contribution to the broad pattern of our history;
- are associated with the lives of people significant in our past;
- embody the distinct characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or are likely to yield, information important in prehistory or history (36 CFR 60.4).

In addition to meeting the significance criteria described above, a significant property must possess "integrity" to be considered eligible for listing in the NRHP. *Integrity* refers to a property's ability to convey its historic significance (National Park Service 1991). Integrity is a quality that applies to historical resources in 7 specific ways: location, design, setting, materials, workmanship, feeling, and association. To be considered eligible for listing in the NRHP, a resource must possess at least 2 of these kinds of integrity qualities, and usually more depending on the context and the reasons why the property is significant.

The NRHP criteria limit the consideration of moved properties because significance is embodied in locations and settings. Under NRHP criteria consideration B, a moved building lacks the integrity of location and setting and would typically be considered ineligible for listing. A moved property can be eligible if it is significant primarily for architectural value, or if it is the surviving property most importantly associated with a historic person or event (U.S. Department of Interior 1991).

Affected Environment

Prehistory

Nels C. Nelson was the first archaeologist to survey the coastline of San Francisco Bay. Nelson's survey, which included the Marin Coast, was conducted between 1906 and 1908 and documented 425 shellmounds along the coast from the Russian River in Sonoma County to Half Moon Bay in San Mateo County (Nelson 1909). Numerous shellmounds occur within a short distance of the

proposed expansion area—to the north and south. Nelson's primary concerns were the distribution, condition, number, and constituents of the shellmounds, which might infer the age and amounts of inhabitants who occupied the sites (Moratto 1974: 63; Nelson 1909). Nelson also recognized the intensive use of shellfish throughout the coastal middens as evidence for a distinct economic base of the region (Moratto 1984: 227). Nelson also performed the first investigations at 3 shellmounds in eastern Marin County in 1909 and 1910.

By 1916, 11 of the sites identified by Nelson had been excavated. Advances were made in archaeological dating methods, and in the 1930s, researchers applied these new techniques to distinguish temporally and culturally discrete assemblages of shell beads and ornaments. More recently, new techniques were developed for determining obsidian sources and exchange routes among different Native American groups throughout California and beyond. In addition, obsidian hydration and radiocarbon dating have been instrumental in establishing dates of occupation for many of the sites within San Francisco Bay Area. Information on human occupation prior to 5000 B.P. is almost non-existent because of the depositional environment of the region and dramatic environmental changes which took place their at this time.

Results from previous archaeological investigations within the expansion area and the surrounding region have shown that the San Francisco Bay Area was inhabited by mobile hunter-gatherers. Over time, their foraging strategies became more focused on the locally obtainable resources, and their lives became increasingly more sedentary. Early inhabitants of the expansion area relied heavily on the resources associated with San Pablo Bay and associated marshes and estuarine environments. Several archaeological sites associated with past use are found near the expansion area and generally inland of the expansion site; most are situated above the historic marshlands.

The vast majority of the expansion area is comprised of agricultural fields, which were once marshland prior to the construction of the levees in the early part of the 20th century. For the past several thousand years, the property existed as tidal marshlands. Before that time, when sea levels of the San Francisco Bay were considerably lower than they are today (Bickel 1978), the prehistoric environmental setting of the area was very different. Prior to the marshland environment, the sea level was considerably lower, and therefore the expansion area could well have been a littoral zone where Native Americans lived and procured marine and bayshore resources. Inundation and sedimentation associated with sea level rise resulted in subsequent deposition of bay mud on the expansion site. Based on cone penetrometer testing conducted in 1991, the depth of bay mud across the site is between 28 and 99 feet (Environmental Science Associates 1993). It is possible that due to the prehistoric use of the site when it was a littoral zone, prehistoric archaeological resources may be present beneath the bay mud layer.

Ethnography

The expansion area was inhabited by the Coast Miwok Indians in the prehistoric past and at the time of European contact. The Coast Miwok language, a member of the Miwokan subfamily of the Utian family, is divided into 2 dialect groups: Western (Bodega) and Southern (Kelly 1978: 414; Shipley 1978: 84). The Coast Miwok territory extended from Duncan's Point on the Sonoma County Coast to the end of the Marin County Peninsula (Kroeber 1925). To the east, Coast Miwok territory extended east as far as midway between the Sonoma and Napa Rivers (Kelly 1978).

The main tribelet in the expansion area was the Omiomi group, which inhabited the valley of Novato Creek on the northwest side of San Pablo Bay (Milliken 1995: 250). The Coast Miwok village of Puyuku is also situated within 1 mile of the expansion site. Coast Miwok villages were usually located near major inland watercourses or, in some cases, along the coast (Kelly 1978: 417).

Contact between the Coast Miwok and Europeans first occurred on the Marin County coast as early as 1579, when Sir Francis Drake spent 5 weeks on the Marin coast to repair his damaged ship (Kroeber 1953: 275). Spanish explorers made contact with the Coast Miwok in the late 1700s. By 1776, the Franciscan fathers of the San Francisco mission began forced conversions of Native Americans to Christianity and brought Coast Miwok to mission lands, causing a partial abandonment of native settlements. Subsequent ranching and settlement by Mexicans and Americans further displaced Coast Miwok from their homes and subjected the group to intense depredations of homicide and epidemic diseases (Bean and Rawls1993: 17).

During the early years of U.S. dominance of California, some Coast Miwok took work in sawmills and as field hands (Kelly 1978: 414). Although the Coast Miwok population declined from approximately 2,000 persons before European contact to 5 individuals by 1920 (Cook 1976: 239), the National Park Service, the Miwok Archaeological Preserve, and individuals of at least partial Coast Miwok descent began recreating the village of Kule Loklo (Bear Valley) on the Point Reyes National Seashore. Dances and local festivals reflecting Coast Miwok traditions are now held at Kule Loklo (Eargle 1986: 67, 84–85). Additional ethnographic information about the Coast Miwok is included in a technical report (Jones & Stokes 2002b).

History

Marin County was one of the original 27 counties created when California became a state in 1850. It is dotted with numerous dairy farms, as well as poultry and stock-raising ranches. The Golden Gate National Recreational Area also makes up a sizeable portion of the county (Hart 1978: 259).

As early as the 1500s, Europeans such as Frances Drake and Sebastian Rodriguez Cermeno explored the region. Spain established Mission San Rafael in present-day San Rafael in 1817. After 1822, Mexico gained independence from Spain and began allowing its citizens land grants throughout Alta California. In 1848, the United States defeated Mexico in the Mexican-American War and Mexico surrendered its Alta California land in the Treaty of Guadalupe Hidalgo. Livestock grazing in addition to agricultural and dairy farming comprised the principal industries during this period (Hoover 1990: 172–174, Mason 1975: 156).

Once California became a state, it assumed ownership of much of the land within its borders including lands under navigable streams, lakes, or harbors, land acquired through purchase, condemnation, or gift, or that which was obtained through rancho land title disputes. In addition, through the Swampland Act of September 28, 1850 (also known as the Arkansas Act), the federal government granted California public land throughout the state (amounting to over 2-million acres) that was subject to overflow and therefore unprofitable for agricultural use unless reclamation work was undertaken (Robinson, 1948: 191–192). With federal assistance, the swamp and overflow land was identified, surveyed, certified, and then patented to the state. The state, in turn, issued a state patent to future swampland purchasers.

The expansion area, a historic marshland, was part of this swamp and overflow acreage. California issued patents for land within the APE in 1863 to Henry Hansen and in 1876 to L.C. McAfee (Marin County Recorder's Office 1868:187–189, 1876b: 565). E. B. Perrin eventually assumed ownership of Hansen and McAfee's property and sold it to John W. Ferris by 1878 (Shannon 1992). In 1892, John W. Ferris a civil engineer and swampland developer from the Central Valley, increased his land holdings by purchasing over 500 additional acres of swampland (including the expansion area) along San Pablo Bay. The state issued a patent to Ferris for his land in 1893 (Dodge 1892, Marin County Recorder's Office 1893: 189).

Although Ferris owned vast amounts of acreage in the area, there is no evidence that he actually resided in Marin County. In 1906, he married Emma Watson, daughter of Claus Spreckels (a sugar tycoon) and moved to England (*San Francisco Chronicle* 1920). Ferris retained ownership of his Marin County property, including the study area, until 1912 when he sold it through an agent in the states to Louis Friedlander and F. K. Houston of San Francisco (Marin County Recorder's Office 1912: 356).

It is unclear when efforts were undertaken to reclaim land in the APE, although early records indicate some reclamation measures were in place in the northwestern part of the study area by 1876 (Marin County Recorder's Office 1876a: 473). By 1898, levees, ditches, and several out buildings were located throughout the project area (Dickins 1898). Between 1910 and 1914, a pump house was constructed in the eastern part of the project area along San Pablo Bay (U.S. Geological Survey 1914, 1916). Although Ferris most likely undertook many of the earlier drainage improvements, it is uncertain whether Ferris or

Friedlander and Houston were directly connected to the later changes, which include the construction of the pump house. Ferris was the least likely candidate for these changes as he was living abroad at that time. Upon purchasing the property, it is probable that Friedlander and Houston rented the reclaimed land to sharecroppers who used it to grow oats and barley (Shannon 1992).

In 1916, California Fruit Canners received title to the property (known as Marin Meadow) and transferred it to California Packing Corporation (Calpak) (now Del Monte) (Marin County Recorder's Office 1917: 458–476). Calpak, a large fruit processing company formed in 1916 from a handful of canners and marketers (including California Fruit Canners), vastly improved irrigation and drainage in the study area to meets its large-scale operating needs. The company constructed additional levees, ditches, and onsite wells, built or improved roads, and put in place a handful of structures, including barns and residences. Over the next 30 years Calpak used the property to grow sugar beets, peas and other crops, as well as breed stallions that were used in the farm operations (Jones & Stokes 1998, Shannon 1992).

By 1948, Calpak sold the property to H. Ward Dawson. Within the next 20 years the southern part of the SLC parcel was reclaimed and used by Hamilton Air Force Base for an antenna field and firing range. Over time additional owners included McAlester Construction Finance and Bel Marin Keys Development Association. In 2001, the State of California purchased the land within the expansion area . Agricultural use of the property still occurs but is limited to dry farming of oat hay (Jones & Stokes 1998, Shannon 1992).

The U.S. military constructed Hamilton Field between 1931 and 1935 as a bombardment base. As one of 3 such bases in the U.S. at the time, the airfield played a vital role in the development of air defense mechanisms on the West Coast in the 1930s and in the training and processing of military units in the early 1940s. From 1947 to 1960, the U.S. Air Force used the facility to conduct defense and training operations and renamed it Hamilton Air Force Base. By the early 1970s, the U.S. Navy and Coast Guard occupied the base, in conjunction with the Air Force. In 1984, the base was conveyed to the U.S. Army and renamed Hamilton Army Air Field. Shortly thereafter, the facility was decommissioned and the land was transferred to private-sector ownership (PAR Environmental Services, Inc. 1993).

Summary of Known Cultural Resources in the APE

Based on the methods described above, 2 historic-period sites and no prehistoric sites have been identified within the proposed expansion area. In addition, a total of 21 architectural resources (buildings, structures, and linear and landscape features) were surveyed and evaluated as part of this study.

Historic Archaeology

The field surveys resulted in the identification of 2 historical resources, a historic trash deposit and the remnants of a demolished 1940s house.

Historic Trash Deposit

The historic trash deposit site comprises a large concentration of historic debris and household items that appear to date back to the 1920s–1940s. There is no evidence of a foundation or remnants of a structure at the trash deposit site. The site contains a concentration of materials scattered between the outboard side of the present-day BMKV outboard levee and the high-tide line on San Pablo Bay, several hundred yards south of the BMKV old pump house. It appears that the historic trash deposit is an intrusive secondary deposit, and at high tide, the site is completely submerged. The site has been evaluated for eligibility for listing in both the NRHP and the CRHR, but it does not meet the criteria of significance for listing in either register.

1940s House

The remnants of the demolished 1940s house are located at the top of the hill on the Conservancy-owned property north of Bel Marin Keys Boulevard, opposite from Headquarters Hill. According to historic maps and personal communication with a local landowner , a house was built at this site in the 1940s and was torn down in the early 1990s. The site has been evaluated for eligibility for listing in both the NRHP and the CRHR, but it does not meet the criteria of significance for listing in either register.

Prehistoric Archaeology

For the purposes and scope of the proposed BMKV expansion, the issue of deeply buried early (5,000 years old and older) prehistoric sites was not pursued further because the proposed BMKV expansion area is not expected to require excavation into the bay-mud layer, and therefore it is unlikely to reach horizons where prehistoric resources may be found. In addition, the current setting of the expansion area does not allow for a subsurface investigation of this research issue. The expansion area is currently below the mean sea level, and the present water table would make it impossible to conduct any kind of trenching or auguring to any depth with meaningful results. No prehistoric resources were identified during the limited field survey conducted within the expansion area.

Historic Architecture and Structures

A brief description and evaluation of NRHP and CRHR eligibility for each architectural resource and landscape and linear feature is presented below. The features located on the BMKV parcel are described below. The features described below for the SLC parcel (the Air Force antenna complex, the Air Force rifle range, and the new pump house) are part of the authorized HWRP.

Several additional identified features, located on adjacent parcels that may be affected by the proposed project, are also described.

Levee and Ditch System (BMKV Parcel)

A system of levees and ditches is located throughout the BMKV parcel. The system lacks integrity, and for this reason, it does not appear to meet the criteria for listing in the NRHP or the CRHR.

Overflow Structure (BMKV Parcel)

An overflow structure is located in the northern part of the BMKV parcel. Lacking historical and architectural significance, the structure does not appear to meet the criteria for listing in the NRHP or the CRHR.

Farm Complex (BMKV Parcel)

A house, barn, and shed sheltered by a eucalyptus grove are located in the north central part the BMKV parcel. The house and barn lack historical and architectural significance. Therefore, they do not appear to meet the criteria for listing in the NRHP or the CRHR. The shed also does not appear to be eligible for listing in the NRHP or the CRHR because it does not meet the exceptional significance criteria established for recently constructed properties. In addition, the eucalyptus grove does not appear to meet NRHP or CRHR criteria because it is a historic landscape feature associated with a structure that lacks historical significance and therefore itself lacks historical significance.

Old Pump House (BMKV Parcel)

A pump house is located along the eastern boundary of the BMKV parcel, adjacent to San Pablo Bay. The old pump house does not appear to meet the criteria for listing in the NRHP or the CRHR because it lacks historical and architectural significance.

Barn (BMKV Parcel)

A large barn is located in a eucalyptus grove directly northeast of Pacheco Pond. The barn does not appear to meet the criteria for listing in the NRHP because the structure was moved; it does not appear to meet the criteria for listing in the CRHR because it lacks historical and architectural significance. The eucalyptus grove also does not appear to be eligible for listing in the NRHP or CRHR because it is a historic landscape features associated with a structure that lacks historical significance, and therefore itself lacks historical significance.

Air Force Antenna Complex (SLC Parcel)

The remnants of an Air Force antenna complex are located in the center of the SLC parcel. The complex includes an operations building, a generator building, and seven 50-foot-tall poles topped by antennas. The buildings comprising the antenna complex do not appear to meet the criteria for NRHP or CRHR eligibility because they are less than 50 years old and do not meet the exceptional significance criteria established for recently constructed properties.

Air Force Rifle Range (SLC Parcel)

A former rifle range (originally part of Hamilton Air Force Base) is located in the southeast corner of the SLC parcel near San Pablo Bay. The range consists of a target range, an ammunitions building, an administration building, a shed, and a target practice field. The rifle range does not appear to be eligible for listing in the NRHP or CRHR because it is less than 50 years old and does not meet the exceptional significance criteria established for recently constructed properties.

New Pump House (SLC Parcel)

A concrete pump house is located west of the firing range. The building does not appear on a 1981 map and most likely was constructed within the last 20 years (U.S. Geological Survey 1959). It does not appear to be eligible for listing in the NRHP or the CRHR because it does not meet the criteria of exceptional significance for recently constructed buildings.

Levee and Ditch System (Pacheco Pond Outlet)

The Pacheco Pond outlet canal includes a system of levees and ditches. The canal is located on the Leveroni property. The system lacks integrity, and for this reason, it does not appear to meet the criteria for listing in the NRHP or the CRHR.

Tidal Gate (Pacheco Pond Outlet)

A tidal gate, owned by MCFCWCD, is located at the end of the Pacheco Pond outlet canal north of Bel Marin Keys Boulevard on the Leveroni property. It is composed of board-formed concrete, with a series of 6 steel check gates. The tidal gate does not appear to meet the criteria for listing in the NRHP or the CRHR because it lacks historical and architectural significance.

Ammunition Bunkers (Ammo Hill)

Two concrete ammunition bunkers are located on Ammo Hill immediately southwest of Perimeter Road which circles the base of the hill. This property was formerly part of the Hamilton Air Force Base and was transferred to the City of Novato in 1999 as part of the GSA Phase II Sale Area. These bunkers are located adjacent to a part of the Bay Trail route in Alternative 1. In 1993, PAR Environmental Services (PAR)evaluated the Hamilton Air Force Base resources for NRHP eligibility. As part of its study, PAR defined the Hamilton Air Force Base Historic District, which included the 2 ammunition bunkers (PAR Environmental Services 1993). As part of this study, Jones & Stokes revisited the bunkers to assess their integrity and to determine whether the 1993 evaluations were still valid. This report finds that NRHP eligibility findings still pertain. The resources also appear to meet the criteria for listing in the CRHR.

Environmental Consequences and Mitigation Measures

Approach and Methods

The following describes the approach used to evaluate impacts on cultural resources associated with implementation of the proposed expansion project.

- Review project activities to identify those actions that may cause an impact on cultural resources.
- Determine whether those activities would occur at the location of significant resources, as described above.
- Apply the impact significance thresholds to determine the significance of impacts in those cases where project activities may affect significant resources.
- Identify measures that could avoid, reduce, eliminate, or compensate for significant impacts.

Impact Mechanisms

Ground-disturbing activities could adversely affect significant archaeological resources in the proposed BMKV expansion area. Ground-disturbing activities could also adversely affect previously unidentified prehistoric cultural resources in the proposed BMKV expansion area.

The demolition, alteration, or removal of significant buildings, structures, or linear and landscape features would constitute a significant impact. There are 2 significant structures in the project area.

Thresholds of Significance

Criteria for Determining Effects under CEQA

According to State CEQA guidelines, a project with an effect that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment (CEQA rev. 1998 Section 15064.5(b)). CEQA further states that a substantial adverse change in the significance of a resource means the physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of a historical resource would be materially impaired. Actions that would materially impair the significance of a historical resource are any actions that would demolish or adversely alter those physical characteristics of a

historical resource that convey its historical significance and qualify it for inclusion in the CRHR or in a local register or survey that meet the requirements of sections 5020.1(k) and 5024.1(g) of the Public Resources Code.

Criteria for Determining Effects under Section 106

Under federal regulations, a project has an effect on a historic property when the undertaking could alter the characteristics of the property that may qualify the property for inclusion in the NRHP, including alteration of location, setting, or use. An undertaking may be considered to have an adverse effect on a historic property when the effect may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:

- physical destruction or alteration of all or part of the property;
- isolation of the property from or alteration of the property's setting when that character contributes to the property's qualifications for listing in the NRHP;
- introduction of visual, audible, or atmospheric elements that are out of character with the property or that alter its setting;
- neglect of a property resulting in its deterioration or destruction; or
- transfer, lease, or sale of the property (36 CFR 800.9).

Impacts and Mitigation Measures of No-Action Alternative

Under the No-Action Alternative, no cultural resources would be disturbed.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact CR-1: No Impact to Known Significant Architectural or Archaeological Resources

Based on archival research and field investigations, implementation of these alternatives would not impact any known significant architectural or archaeological resources. The proposed BMKV expansion area does not appear to have a high potential for the inadvertent discovery of archaeological resources.

Impact CR-2: Potential Impacts to Buried Cultural Deposits or Human Remains

Construction activity may encounter unexpected buried cultural deposits or human remains. This impact is considered significant. To reduce this impact to a less-than-significant level, the following mitigation measures would be implemented.

Mitigation Measure CR-1: Stop Work if Buried Cultural Deposits Are Encountered during Construction Activities.
If buried cultural resources, such as chipped stone or groundstone, historic debris, building foundations, or human bone, are inadvertently discovered during ground-disturbing activities, work will stop in that area and within a 100-foot radius of the find until a qualified archaeologist can assess the significance of the find.

Mitigation Measure CR-2: Stop Work if Human Remains are Encountered during Construction Activities.
If human skeletal remains are encountered, the county coroner will be contacted immediately. If the county coroner determines that the remains are Native American, the coroner will then be required to contact the NAHC (pursuant to Section7050.5 (c) of the California Health and Safety Code) and the County Coordinator of Indian Affairs. A qualified Jones & Stokes archaeologist will also be contacted immediately.

If any human remains are discovered in any location other than a dedicated cemetery, there will be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:

- the county coroner has been informed and has determined that no investigation of the cause of death is required; and
- if the remains are of Native American origin,
    - the descendants from the deceased Native Americans have made a recommendation to the landowner or the person responsible for the excavation work for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Public Resources Code Section 5097.98; or
    - the NAHC was unable to identify a descendent or the descendent failed to make a recommendation within 24 hours after being notified by the commission.

According to the California Health and Safety Code, 6 or more human burials at 1 location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052). Section 7050.5 requires that construction or excavation be stopped in the vicinity of discovered human remains until the coroner can determine whether the remains are those of a

Native American. If the remains are determined to be Native American, the coroner must contact the NAHC.

Impacts and Mitigation Measures Unique to Alternative 1

Impact CR-3: Potential Cultural Resources Impacts Resulting from Construction of the Bay Trail, Alternative 1

Two architectural resources (ammunition bunkers) are located adjacent to the Bay Trail route proposed under Alternative 1. The 2 bunkers were recommended as eligible for the NRHP as contributors to the Hamilton Air Force Base Historic District in 1993 by PAR Environmental Services (PAR Environmental Services 1993). Based on field investigations conducted by Jones & Stokes during 2002, the NRHP eligibility findings still pertain, and the resources appear to meet the CRHR criteria.

Both bunkers are constructed of concrete and are buried in the base of a partially artificial hill known as Ammo Hill. The proposed trail alignment would be located on top of an existing dirt road that runs adjacent to the bunkers and the hill. Implementation of this project activity is not anticipated to cause the physical destruction, relocation, or alteration of the bunkers and therefore would not impair their ability to convey historical significance. Therefore, any modification to the bunkers would not constitute a significant impact.

Aesthetics

Affected Environment

Data Sources

The evaluation of aesthetics is based on information contained in the *Bel Marin Keys Unit 5 Final Environmental Impact Report/Environmental Impact Statement* (Environmental Science Associates 1993), and information collected during site visits conducted in Spring 2002.

Adjacent Land Uses

The BMKV site abuts San Pablo Bay along the site's entire eastern side. A portion of the site's northeastern side lies adjacent to Novato Creek. On its northern side, the site lies adjacent to the BMK housing development. On its western wide, the site is adjacent to Pacheco Pond. On its southwestern side, the site borders the HAAF parcel. On its southeastern side, the BMKV parcel is adjacent to the SLC parcel.

Viewer Groups

The primary viewers of the expansion site are the occupants of the BMK residential homes that abut the edge of the BMKV parcel. Other viewers includes pedestrians and roadway travelers who use the public streets.

There are no designated public scenic vista points in the BMK residential area in close proximity to the south lagoon berm that separates the lagoon from BMKV although the BMKV parcel is visible from the ends of public streets.

Key Viewpoints

Five key viewpoints were established in order to assess impacts to aesthetic resources within the expansion area. Locations and directions of these viewpoints are identified in figure 4-16 and described below. The view from each of these viewpoints is also depicted in representative photographs shown in figure 4-17.

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Figure 4-16
Key Viewpoints at the Bel Marin Keys Unit V Expansion Site

Viewpoint 1: View from the eastern end of Bel Marin Keys Boulevard to the east

Viewpoint 2: View from the eastern end of Bahama Reef to the southeast

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Figure 4-17
Views of the Bel Marin Keys Unit V Expansion Site from Streets in the Bel Marin Keys Residential Community

Viewpoint 3: View south from the southern end of Del Oro Lagoon to the south

Viewpoint 4: View from the southern end of Dolphin Isle to the southeast

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Figure 4-17 (continued)
Views of the Bel Marin Keys Unit V Expansion Site from Streets in the Bel Marin Keys Residential Community

Viewpoint 5: View from the southern end of Caribe Isle to the southeast

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Figure 4-17 (continued)
Views of the Bel Marin Keys Unit V Expansion Site from Streets in the Bel Marin Keys Residential Community

Viewpoint 1

Viewpoint 1 is located at the eastern end of Bel Marin Keys Boulevard, adjacent to the south lagoon lock structure. The view faces east towards San Pablo Bay. The viewshed primarily consists of the south lagoon in the foreground (including the boat lock), flat farmland and a utility tower in the middle ground, and isolated hills in the background. San Pablo Bay is a small portion of the background view from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the existing outboard levee.

Viewpoint 2

Viewpoint 2 is located south of Viewpoint 1, at the eastern end of Bahama Reef in the BMK residential area. The view faces east towards San Pablo Bay. The viewshed primarily consists of the south lagoon in the foreground and flat, vegetated land in the middle ground and background. Views from this viewpoint are clear and unobstructed by utilities or other physical structures. San Pablo Bay is a small portion of the background view from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the existing outboard levee.

Viewpoint 3

Viewpoint 3 is located southwest of Viewpoint 2, at the southeastern end of Del Oro Lagoon in the BMK residential area. The view faces southeast towards HAAF and San Pablo Bay. The viewshed primarily consists of the south lagoon in the foreground, flat farmland in the middle ground, and isolated trees (on the SLC parcel) and distant rolling hills in the background. Views from this viewpoint are clear and unobstructed by utilities or other physical structures. San Pablo Bay is a small portion of the background view from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the existing outboard levee.

Viewpoint 4

Viewpoint 4 is located southwest of Viewpoint 3, at the end of Dolphin Isle in the BMK residential area. The view faces southeast towards HAAF. The viewshed primarily consists of the south lagoon in the foreground, an isolated tree and old farmhouse structure in the middle ground, and distant views of flat farmland and rolling hills in the background. Views from this viewpoint are non-contiguous. San Pablo Bay is barely visible from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the existing outboard levee.

Viewpoint 5

Viewpoint 5 is located west of Viewpoint 4, at the south end of Caribe Isle in the BMK residential area. The view faces south towards HAAF. The viewshed primarily consists of the south lagoon in the foreground and middle ground, and distant views of flat farmland, rolling hills, and utility structures in the background. Views from this viewpoint are unobstructed.

Environmental Consequences and Mitigation Measures

This section describes the methods used to analyze potential impacts of the restoration alternatives compared to the No-Action Alternative, potential impacts and impact mechanisms of each restoration alternative, and recommended mitigation measures to reduce significant impacts to a less-than-significant level.

Approach and Methodology

The impacts of the restoration alternatives were evaluated by analyzing the change in the visual character of the BMKV site and the change in views of the site from adjacent public areas and private areas within the BMK residential area.

The existing visual character was identified by visiting the site and taking photographs from key vantage points (see figure 4-17 above). The future visual character is based on the designs identified in chapter 3.

Visual lines of site were determined by using 2 elevations at the key viewpoints to represent street-level/ground-floor views (13 feet NGVD—7 feet for street level + 1.5 feet for foundation + 4.5 feet to viewer height) and second-story views (23 feet NGVD—ground floor + 10 feet) from the ends of southward-facing streets. Elevations of the existing site were identified from prior levee and topographic surveys. Elevations of the future site with implementation of the restoration alternatives were based on the conceptual designs described in chapter 3.

The change in views resulting from building new or improved levees was identified by graphing the line of site from the key viewpoints to features within the restoration site affected by construction of the different alternatives. Examples of the profiles generated for several of the key viewpoints are included in appendix F for the three different alternatives.

Impact Mechanisms

The restoration alternatives include changing the existing aesthetic character of the BMKV site from predominantly agricultural to a mosaic of grassland, seasonal wetland, and tidal marsh. This would represent a change in the character of the views from adjacent areas.

The restoration alternatives also include the construction of new levees and improvement of existing levees and berms. These new and improved levees may alter or obstruct existing views of the restoration site.

Thresholds of Significance

The following significance criteria were used to evaluate the proposed BMKV expansion. Regarding aesthetics, the proposed expansion was identified as resulting in a significant impact on the environment if it would

- substantially degrade the aesthetic character of BMKV from adjacent viewpoints; or
- substantially obstruct existing unobstructed views of the BMKV site or of San Pablo Bay from public viewing locations or a substantial number of adjacent residences.

Impacts and Mitigation Measures of the No-Action Alternative

Under the No-Action Alternative, no wetland restoration would occur, and the expansion site would remain in its present condition. No change in the current views would be anticipated, and no mitigation measures would be required.

Impacts and Mitigation Measures Common to Alternatives 1–3

Impact AE-1: Change in Aesthetic Character of BMKV Site

The existing views from certain public streets and private residences that face directly onto the BMK south lagoon adjacent to BMKV include views of the BMKV site itself. The restoration alternatives would replace the existing agricultural fields, which dominate the existing view, with grassland, seasonal wetlands, and tidal marsh. While this represents a change in the aesthetic

character of the BMKV site, the proposed restoration, particularly the tidal marsh area, represents a return of the site to an approximation of the habitats and views that were present prior to agricultural development. Individual viewers may have subjective preferences for agriculture or for open space and habitat. However, the aesthetic character of the BMKV site with implementation of the project is expected to be generally perceived of as attractive and positive and aesthetically equivalent overall to the existing agricultural character of the site. Thus, while restoration would change the aesthetic character of the site, the restoration alternatives are not expected to substantially degrade the aesthetic character of the BMKV site and or the aesthetic character of existing views of the BMKV site. The potential for obstruction of views is discussed separately below.

Impacts and Mitigation Measures Unique to Alternative 1

Impact AE-2: Obstruction of Existing Unobstructed Views of BMKV Site and San Pablo Bay, Alternative 1

The existing views from certain public streets and private residences that face directly onto the BMK south lagoon adjacent to BMKV include views of the south lagoon, the agricultural fields at BMKV, and, from elevated viewpoints, San Pablo Bay in the background.

From the street level and ground floors in the residential area, the viewshed is characterized by the BMK south lagoon in the foreground and agricultural fields on the BMKV parcel (and its associated natural habitats) in the middle ground and background. San Pablo Bay is visible in the far background from the street level/ground floor, but it is a small portion of the background because of the distance to the bay and the presence of the existing outboard levee. Views from the second-story level are similar to ground-floor views but are substantially less obstructed by existing levees, and San Pablo Bay is a distinct part of the background.

Under Alternative 1, a new levee would be built approximately 1,000 feet east and south of the south lagoon levee, at an initial elevation of approximately 12 feet NGVD, which includes a 4-foot allowance for settlement, resulting in a final elevation of 8 feet NGVD. In addition, the existing south lagoon berm, which presently varies between 2 and 5 feet NGVD, would be improved to an initial elevation of approximately 10 feet, which includes a 4-foot allowance for settlement, resulting in a final elevation of 6 feet NGVD.

The height of the new and improved levees would change a portion of the existing views from the street level/ground floor. The upland transition zone/swale area would be visible from the street level/ground floor. This view would be similar to the existing views of the nearest portions of BMKV. In the middle ground, the street-level/ground-floor view of the tidal marsh restoration

area would be obstructed by the new levee. In the background, the street level ground floor view of San Pablo Bay would be obstructed by the new levee. No change would occur to street-level/ground-floor views of the BMK south lagoon.

For second-story views, the lagoon, swale area, eastern part of the tidal marsh restoration area, and San Pablo Bay would be still be viewable, but a portion of the middle-ground view of the restoration area would be obstructed by the new levee. The view of the San Pablo Bay would be similar to the existing view and may be slightly improved by elimination of the outboard levee.

Under Bay Trail Spur Options 1A, a spur trail would provide public views of the restoration site and San Pablo Bay from the central levee. Under Alternative 1, views would also be available from portions of the Bay Trail itself.

The new levee would obstruct portions of existing views from street level/ground floor for southward-facing homes in the southern part of the BMK residential area, but it would have a limited effect on second-story views. While unobstructed views would be available from the Bay Trail and from the optional spur trail, if built, the partial obstruction of street level/ground floor views is considered a significant impact.

The primary determinant of change in views is the height and location of the new levee, which is designed to protect BMK south lagoon and residential area from tidal flows introduced into the BMKV site. The primary mitigation measures available for this impact would be to lower the levee heights of the south lagoon levee improvement, lower the initial construction height of the new levees and move the outboard levee location further away from the BMK residential area.

The final design height of the new outboard levee (8 feet NGVD) cannot be lowered without compromising tidal flooding protection. Revised Alternative 2 considers an alternative initial construction height for the improvement of the south lagoon levee of 6 feet NGVD (as opposed to 10 feet NGVD), an alternative initial construction height for the new levee of 10 feet NGVD (as opposed to 12 feet NGVD), and an alternative location for the outboard levee further from the BMK residential area. Were Alternative 1 to be implemented, the revisions in levee heights and locations described in Revised Alternative 2 could be included in Alternative 1 to reduce this impact to less than significant, although the levee relocation would reduce the area available for tidal marsh restoration.

Impacts and Mitigation Measures Unique to Revised Alternative 2

Impact AE-3: Obstruction of Existing Views of BMKV Site and San Pablo Bay, Revised Alternative 2

As described in chapter 3, several changes were made to the design of Alternative 2, including changes that would affect the views of the BMKV site and San Pablo Bay. Under Revised Alternative 2, the new outboard levee would be built approximately 1,500 feet east and south of the south lagoon levee, at an initial height of approximately 10 feet NGVD, which includes a 2-foot allowance for settlement, resulting in a design height of 8 feet NGVD. The lowering of the initial construction height will require two additional levee raising efforts, one about 6 to 7 years after initial levee construction and one just prior to final outboard levee breaching (about 13 years after initial levee construction). In addition, the existing south lagoon levee, which presently varies in height between 2 and 5 feet NGVD, would be improved to an initial height of approximately 6 feet NGVD, which includes a 1-foot allowance for settlement, resulting in a design height of 5 feet NGVD. Furthermore, a spur trail would not be constructed as part of the Revised Alternative 2 design.

The height and location of the new and improved levees would change a portion of some of the existing views from the street level/ground floor. No change would occur to street-level/ground-floor views of the BMK south lagoon. In the foreground, the seasonal wetland and upland areas in the BMKV swale area would be visible from the street level/ground floor. This view would be similar to the existing views of the nearest portions of BMKV. In the middle ground, the street-level/ground-floor view of the western side of the tidal marsh restoration area would be obstructed by the new levee, although the eastern side of the tidal marsh restoration area would be visible. Over time, as the levee settles to its design height, a greater portion of the eastern part of the tidal marsh restoration area should become visible. In the background, the view of San Pablo Bay would be similar to the existing view and may be slightly improved by elimination of the existing outboard levee.

For second-story views, the lagoon, swale area, the eastern part of the tidal marsh restoration area, and San Pablo Bay would be viewable, but a portion of the middle-ground view of the western part of the tidal marsh restoration area would be obstructed by the new outboard levee. A greater part of the tidal marsh restoration area would be observable from second floors than from first floors. Over time, as the levee settles to its design height, a greater portion of the tidal marsh restoration area should become visible. The view of the San Pablo Bay would be similar to the existing view and may be slightly improved by elimination of the outboard levee.

The new levee would obstruct portions of existing views of a portion of the BMKV parcel from street level/ground floor for southward-facing homes in the

southern part of the BMK residential area, but it would not substantially change views of San Pablo Bay. This alternative would have a limited effect on second-story views. Views from the new Bay Trail would be unobstructed. The obstruction of a portion of existing views from street level/ground floor for some residences under Revised Alternative 2 represents the least amount of levee encroachment on the existing lines of sight from this position in comparison to Alternatives 1 and 3. The partial obstruction of some of the existing street-level/ground-floor views of a portion of the BMKV is considered a less-than-significant impact because the foreground views are preserved, the eastern part of the tidal marsh restoration area would be visible, and the background views of San Pablo Bay would be similar to those at present

Impacts and Mitigation Measures Unique to Alternative 3

Impact AE-4: Obstruction of Existing Views of BMKV Site and San Pablo Bay, Alternative 3

Under Alternatives 3, a new levee would be built approximately 50 feet east and south of the eastern portion of the south lagoon levee, at an initial elevation of approximately 12 feet NGVD, which includes a 4-foot allowance for settlement, resulting in a final elevation of 8 feet NGVD. In addition, the western portion of the existing south lagoon berm, which varies between 2 and 5 feet in elevation, would be improved to an initial elevation of 10 feet NGVD, which includes a 4-foot settlement allowance, resulting in a final elevation of 6 feet NGVD. The height of the new and improved levees would change a portion of the existing views from street level/ground floor and could affect views from second stories of private residences.

From street level/ground floor, the proximity of the new levee to the viewpoints would obstruct all views of the BMKV site and a portion of the background view of San Pablo Bay under this alternative. For street-level/ground-floor views, this impact would be more severe than the obstruction described above for Alternative 1 and Revised Alternative 2. From second stories, the BMKV site and San Pablo Bay would still dominate the views and would not be substantially obstructed.

Under Spur Option 3A, a spur trail along the new levee would provide unobstructed views of the restoration site and San Pablo Bay. Unobstructed views would also be available along portions of the Bay Trail itself.

The new levee would obstruct existing views from street level/ground floor for some of the southward-facing homes in the southern part of the BMK residential area. Although unobstructed views would be available from the Bay Trail and from the optional spur trail, if built, this is considered a significant impact.

The primary determinant of change in views is the height and location of the new levee, which is designed to protect BMK south lagoon and residential area from tidal flows introduced into the BMKV site. The primary mitigation measures available for this impact would be to lower the levee heights of the south lagoon levee improvement, lower the initial construction height of the new levees and move the outboard levee location further away from the BMK residential area.

The final design height of the new outboard levee (8 feet NGVD) cannot be lowered without compromising tidal flooding protection. Revised Alternative 2 considers an alternative initial construction height for the improvement of the south lagoon levee of 6 feet NGVD (as opposed to 10 feet NGVD), an alternative initial construction height for the new levee of 10 feet NGVD (as opposed to 12 feet NGVD), and an alternative location for the outboard levee further from the BMK residential area. Were Alternative 3 to be implemented, the revisions in levee heights and locations described in Revised Alternative 2 could be included in Alternative 3 to reduce this impact to less than significant, although the levee relocation would reduce the area available for tidal marsh restoration significantly, compared to the habitat components contained in Alternative 3 at present.

Chapter 5
Other Required Analyses

This chapter addresses other required analyses of the proposed BMKV expansion as required by NEPA and CEQA, including cumulative impacts, irreversible and irretrievable commitments of resources, and the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. Each of the different analyses is presented below.

Cumulative Impacts

Requirements for Analysis

The CEQs NEPA regulations (40 CFR 1580.25) and State CEQA Guidelines (Section 15130) require a reasonable analysis of the significant cumulative impacts of a proposed project[1]. *Cumulative impact* refers to "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." The cumulative impact that results from several closely related projects is:

> "the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time (State CEQA Guidelines, Section 15355[b]). The cumulative impact analysis may be less detailed than the analysis of the project's individual effects (State CEQA Guidelines Section 15130[b])."

Approach to Cumulative Impact Analysis

The methodology used to develop the cumulative impact analysis included reviewing the current general plans for the City of Novato and Marin County, the *Hamilton Army Wetland Restoration Plan Final EIR/EIS* (Jones & Stokes 1998),

[1] The term *project* used in this SEIR/EIS refers explicitly to the term as defined under CEQ's regulations for NEPA and the State CEQA Guidelines: "the entirety of an action which has a potential for resulting in a physical change in the environment." The Corps defines *project* as "an action that has been authorized by Congress," such as the HWRP. The BMKV expansion has not been authorized by Congress.

the *Oakland Harbor Navigation Improvement (50-Foot) Project Final EIR/EIS* (U.S. Army Corps of Engineers and the Port of Oakland 1998a), and the *Long-Term Management Strategy Draft EIS/EIR* (U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, San Francisco Bay Conservation and Development Commission, San Francisco Regional Water Quality Control Board, and State Water Resources Control Board 1996). These projects and plans are described in publicly available documents.

In addition, preliminary information about the Black Point Antenna Field Restoration Project (BPAFRP) was also reviewed (U.S. Army Corps of Engineers 2001a). Public information about the BPAFRP is not currently available because it is in the early planning stages. The current proposal is briefly described here. The project area is located on SLC-owned land in the City of Novato, along the north side of Novato Creek, approximately 1 mile south of State Highway 37 and approximately 1 mile from the confluence of Novato Creek and San Pablo Bay. The site is approximately 0.5 mile from BMKV. The site is surrounded by MCFCWCD land on the west, north, and east. The proposed BMKV expansion would restore approximately 130 acres of tidal wetland adjacent to Novato Creek to provide habitats for threatened and endangered species. The physical changes associated with the BPAFRP would include: removing abandoned concrete work shed and antenna towers; constructing a new levee inland of the existing levee; providing protection, as necessary, for the new levee to ensure wind, wave and tidal actions, and seasonal flood flows do not cause excessive erosion; reestablishing historical tidal action by blocking artificial drainage ditches and removing culverts, as appropriate; breaching the creekside levee to reconnect diked wetland with Novato Creek; and allowing natural sedimentation to restore the site to the equilibrium marsh elevations and a tidal channel system (U.S. Army Corps of Engineers 2001a).

This multiple-source approach provided information about whether the proposed BMKV expansion would contribute to significant cumulative effects.

The proposed BMKV expansion is proposed as a supplement to the HWRP, with the ultimate result being a contiguous natural habitat area. In general, the proposed BMKV expansion would result in a benefit to the environment in terms of biological resources and would preclude development of the site for other intensive land uses.

Geology, Soils, and Seismicity

The San Francisco Bay Area, the region in which the proposed wetland restoration would occur, is one of the most seismically active regions in the nation. The development of the proposed BMKV expansion is not expected to exacerbate or contribute to seismic hazards. Requirements to conduct geotechnical investigations and develop appropriate design for the levees prior to project construction would necessitate fully analyzing and addressing potential risk for exposure of people to seismic hazards. Because detailed design is

expected to result in appropriate levee design, the BMKV expansion is not expected to contribute considerably to a significant cumulative impact.

Surface-Water Hydrology and Tidal Hydraulics

Implementation of any of the restoration alternatives for the BMKV expansion would result in limited but positive reduction in flood risk to the areas surrounding Pacheco Pond. Existing flows from the BMK south lagoon would be accommodated by any of the restoration alternatives. The increased tidal prism that would result from implementation of any of the alternatives would likely cause a limited increase of tidal scouring of the lower portion of Novato Creek, which would be a positive but limited improvement in the flood capacity of this portion of the creek, and a positive but limited benefit to navigability.

Because conceptual design for the BPAFRP has not been completed, no conclusions can be made about the impacts of the BPAFRP on flooding at this time. Like BMKV, increased tidal prism due to tidal restoration at the BPAFRP is likely to result in increased tidal scouring of the lower portion of Novato Creek, which could widen this portion of the creek.

The cumulative effect on Novato Creek morphology from both BMKV and the BPAFRP (if implemented) is expected to be increased channel widening of the lower portion of Novato Creek as a result of the increased tidal prism. This channel widening would result in a loss of existing tidal mudflat and/or marsh along the creek, but this impact would be offset by the significant increase in tidal mudflat and marsh at the BMKV and BPAFRP sites. Channel widening would also be mildly beneficial to the navigability of the last mile of Novato Creek, though it is unknown whether the effect would reduce the need for periodic maintenance dredging to allow for boat access to the BMK lagoons. Channel widening would also increase the flood capacity of this portion of Novato Creek. However, given the dominance of tidal stage in flooding events, it is doubtful that this would significantly lower flood stage.

As described above, the BMKV wetland restoration alternatives are not expected to result in a physical adverse effect on flooding, and thus would not contribute to a cumulative significant physical effect on flooding.

Conclusions regarding the specific impacts of the BPAFRP on flooding cannot be determined at this time because conceptual designs and plans for wetland restoration have not been completed.

Water Quality

Implementation of any of the wetland restoration alternatives along with other projects envisioned in the area, including the BPAFRP, would result in potential

water quality impacts on Novato Creek and San Pablo Bay during construction due to sedimentation resulting from breaching of levees and placement of dredged material. However, as described in the previous chapter, construction controls on sedimentation are expected to reduce this impact to less than significant.

The BMKV expansion would also reduce flow from Pacheco Pond to Novato Creek; however this reduction in flow is not expected to have a significant effect on water quality in the creek because of the dominance of tidal flows in this reach of the creek. Both the BMKV expansion and the BPAFRP would increase tidal flow in the last mile of Novato Creek, which would enhance tidal flushing and improve water quality along this portion of the creek.

As the wetlands at the HWRP (including BMKV), BPAFRP, and other sites develop, overall water quality is expected to improve compared to existing conditions because functioning wetlands filter contaminants from runoff and enhance water quality. Furthermore, because the HWRP and the proposed BMKV expansion envision the use of dredged material for wetlands therefore reducing the potential for disposing of the material in the Bay or ocean, the HWRP with proposed the BMKV expansion would result in a net cumulative benefit to water quality of the Bay and ocean. This benefit is one of the objectives of the LTMS.

As discussed in the previous chapter, it is currently unknown whether the effects of the BMKV restoration alternatives on methylmercury production would be more notable than the natural methylation processes. It is generally thought that restoring large areas of tidal marsh throughout the San Francisco Bay region would be beneficial to the environment. However, large-scale restoration projects could expose populations of special-status species to increased concentrations of methylmercury, if new areas of tidal marsh added over a short period of time actually resulted in an increase of mercury methylation over existing conditions. Mitigation Measure WQ-1 requires the implementation of a methylmercury adaptive management plan based on consultation with the relevant local, state, and federal agencies. The likely outcome of the adaptive management plan would be informed decision making that would guide the phased restoration of tidal marshes throughout the estuary. Given the proximity of the BPAFRP to the BMKV expansion site and of both sites to Novato Creek, information and approaches to management of this issue may need to be coordinated between the 2 projects to reduce the potential effects on water quality within Novato Creek. Depending on the findings of the subsequent study, it may be necessary to schedule the amount and timing of restoration activity to reduce mercury methylation within water bodies adjacent to multiple wetland restoration projects. However, because it currently remains unknown whether wetland restoration would actually result in increased mercury methylation, an adaptive management approach is appropriate.

Apart from the methylmercury potential noted above, the BMKV expansion is not expected to result in a considerable contribution to a significant cumulative water quality impact.

Public Health

Implementation of the proposed HWRP with the BMKV expansion would increase the potential for mosquito production but would not contribute to a significant cumulative impact because mosquito abatement practices would be implemented as deemed necessary on the HWRP and the BMKV expansion site and would be expected to be incorporated on any new mosquito habitat areas that might be created as the part of the BPAFRP. This would eliminate the potential for the BMKV expansion to contribute considerably to a significant cumulative public health impacts.

Biological Resources

The HWRP and the BMKV expansion alternatives would ultimately increase the acreages of tidal marsh habitat available for sensitive wildlife species (see table 5-1). The BPAFRP would also increase tidal marsh habitat. Although existing tidal and nontidal wetlands would be lost due to construction and/or fill activities at these sites, the cumulative effect of restoration is expected to result in a net overall increase in habitat value, particularly for tidal-marsh-dependent species in this portion of San Pablo Bay. Therefore, the proposed BMKV expansion is expected to contribute considerably to a cumulative beneficial impact for biological resources.

Land Use and Public Utilities

The proposed BMKV expansion is generally consistent with the land use designations in local plans. Although, locally important farmland would be converted to a habitat use, the change in use of the project site to wildlife habitat is a generally compatible use. Similarly, the proposed restoration of the BPAFRP site is expected to be consistent with land use designations and result in a less-than-significant loss of relatively low-quality farmland. The proposed BMKV expansion, in combination with the BPAFRP, is not expected to result in a significant cumulative impact on utilities because both projects are expected to accommodate existing utilities and not result in an increase in population, housing, or economic growth that would create additional demand for these services.

During the dry season, NSD-treated wastewater is used for spray irrigation on the fields adjacent to Highway 37. Provided a new inboard levee were constructed

Table 5-1. Cumulative Habitats, HWRP and BMKV Expansion

Habitat	BMKV No Action	BMKV Alt. 1	BMKV Alt. 2	BMKV Alt 3	HAAF/SLC No Action (From 404b1)	HAAF/SLC Project (from 404b1)	Total No Action	Total Restored (Alt.1)	Net Change	Total Restored (Alt.2)	Net Change	Total Restored (Alt.3)	Net Change
Tidal Marsh	18	849	792	1204	120	690	138	1539	1402	1482	1345	1894	1757
High Transitional Marsh	0	160	79	30	0	0	0	160	160	79	79	30	30
Tidal Panne	0	0	0	0	0	41	0	41	41	41	41	41	41
Tidal Pond	0	0	0	0	0	4	0	4	4	4	4	4	4
Low Marsh	0	30	28	40	0	0	0	30	30	28	28	40	40
Tidal Wetlands Subtotal	*18*	*1039*	*899*	*1274*	*120*	*735*	*138*	*1774*	*1636*	*1634*	*1496*	*2009*	*1871*
Tidal Mudflat	2	57	48	67	0	22	38	79	41	70	32	89	51
Subtidal Channels	0	90	72	130	0	44	0	134	134	116	116	174	174
Other Tidal Subtotal	*2*	*147*	*120*	*197*	*0*	*66*	*122*	*213*	*91*	*186*	*64*	*263*	*141*
Saline Seep/Non-Tidal Salt Marsh	21	0	0	0	0	0	21	0	-21	0	-21	0	-21
Brackish Open Water and Marsh	52	50	33	50	17	2	69	52	-17	35	-34	52	-17
Seasonal Wetland	114	40	277	10	36	62	150	102	-48	339	188	72	-78
Non-Tidal Habitats Total	*187*	*90*	*310*	*60*	*53*	*64*	*240*	*154*	*-86*	*374*	*134*	*124*	*-116*
Agricultural Ponding	151	0	0	0	0	0	151	0	-151	0	-151	0	-151
Agriculture (Non-ponding)	1090	0	0	0		0	1090	0	-1090	0	-1090	0	-1090
Grassland	129	300	247	45	493	85	622	385	-237	332	-289	130	-492
Developed	***0***	***0***	***0***	***0***	***284***	***0***	***284***	***0***	***-284***	***0***	***-284***	***0***	***-284***
Upland Total	***1370***	***300***	***247***	***45***	*777*	***85***	***2147***	***385***	***-1762***	*332*	***-1814***	***130***	***-2017***
Tidal Habitats Total	***20***	***1186***	***1019***	***1471***	***120***	***801***	***140***	***1987***	***1847***	***1820***	***1680***	***2272***	***2132***
Non-Tidal Habitats Total	***187***	***90***	***310***	***60***	*53*	***64***	***240***	***154***	***-86***	*374*	***134***	***124***	***-116***
TOTAL	**1576**	**1576**	**1576**	**1576**	**950**	**950**	**2526**	**2526**	**0**	**2526**	**0**	**2526**	**0**

as part of the BPAFRP to prevent introduced tidal flow across the site, the use of the fields for spray irrigation of treated wastewater would not be disrupted.

As noted above, the combined effect of the BMKV expansion and the BPAFRP would be an increase in the tidal prism of the lower portion of Novato Creek, which would result in some channel widening and a minor depth increase in the main channel below the levee design breaches. This would be a minor benefit to navigation.

Hazardous Substances and Waste

In addition to and separate from the BMKV expansion, there are remedial processes currently underway for areas of identified contamination at the HAAF and SLC parcels. Remedial issues at the HAAF parcel (including Navy Ballfields) are being addressed through the BRAC process. Remedial issues at the SLC parcel are being address through the FUDS remedial process.

The BMKV expansion makes no determinations regarding potential remedial activities at the HAAF (including the Navy Ballfields) or SLC parcels. The BMKV expansion assumes that the BRAC and FUDS processes will result in implementation of remedial approaches that will clean up any contaminated sites to a condition suitable for the proposed wetlands reuse. If the remedial determinations ultimately made through BRAC or FUDS required changes in the wetland designs proposed for the HAAF or SLC parcels, the BMKV and HWRP lead agencies would evaluate the potential effects of the changes and determine whether additional NEPA/CEQA compliance would be necessary. Currently, the lead agencies consider it speculative to assume that the BRAC or FUDS process will not result in remedial options that leave the sites suitable for the proposed wetland use.

The proposed BMKV expansion would not exacerbate or cumulatively contribute to hazardous materials impacts. Prior to commencement of construction activities, the lead agencies would conduct or supervise proper cleanup activities of any potential hazardous substances and/or waste on the BMKV parcel in compliance with local, state, and federal regulations. Similarly, remediation of potential hazardous substances and/or waste, as required, at the adjacent HAAF or SLC parcels would be conducted prior to wetland restoration activities at the site. The additional placement of dredged material on a part of the SLC parcel would decrease the potential for channel formation in this part of the HWRP, thereby decreasing the potential for contaminant migration should a remedial approach involving leaving contaminated soil *in situ* be selected.

Like the SLC parcel, the BPAFRP is a FUDS site because it was owned by the military prior to transfer to the SLC and may contain residual contaminated areas. The military removed underground and aboveground storage tanks and oil filled transformers of various types as part of the transfer of the property to the SLC, but there could be additional contamination on this former military site.

The site is therefore listed with FUDS. Similar to the process at the SLC parcel, it is expected that remediation of potential hazardous substances and/or waste, as required, at the BPAFRP would be conducted prior to wetland restoration activities at the site

Because the HWRP, the proposed BMKV expansion, and the BPAFRP would remediate potentially contaminated media to levels suitable for wetland use, the BMKV expansion is not expected to contribute considerably to a cumulative significant impact related to hazardous substances and waste.

As discussed in chapter 4, both the BMKV expansion and the HWRP would only use dredged sediment material that is found suitable by the DMMO for use as cover material. Therefore, neither is expected to contribute cumulatively to an increased risk of exposure to potentially contaminated sediment. The BPAFRP is not currently proposed to utilize dredged material as part of restoration.

Potential increases in methylation of mercury due to wetland processes involving dredged materials or sediments deposited on the site from Novato Creek or San Pablo Bay that contain mercury was discussed above under *Water Quality*.

Transportation, Air Quality, and Noise

Construction traffic would represent a short-term minor increase in traffic that could contribute to traffic congestion on roadways in the City of Novato and adjacent areas and on state facilities. If construction at the HWRP and the BMKV expansion occurred at the same time, the cumulative effect on local traffic would be increased. Because this traffic would temporarily exacerbate congestion on some roadways that are already operating at an unacceptable LOS (see previous chapter), it is recommended that a construction traffic plan be implemented as part of the final design for both. The construction plan would ensure that construction traffic is routed through appropriate non-congested intersections and is concentrated during off-peak hours. Access to the BPAFRP is by Highway 37, so no cumulative effect from parallel construction at the BMKV site and the BPAFRP site would be expected.

Construction activity associated with the proposed BMKV expansion is expected to result in annual emissions that are below BAAQMD *de minimis* threshold levels for ozone precursors, with implementation of mitigation measures for PM10 and for the dredged material unloading pumps, as discussed in chapter 4. The BAAQMD thresholds are designed to evaluate individual projects in light of the cumulative environment of Bay Area air quality, and thus a project that does not result in emissions above the thresholds does not result in a considerable contribution to a cumulative impact on air quality. Construction activity therefore would not cause or contribute to any new ambient-air-quality standard violation, increase the severity or frequency of any existing standard violation, or delay timely attainment of any standard (see chapter 4). In addition, as discussed in the *Oakland Harbor Navigation Improvement Project EIR/EIS*, cumulative air

quality emissions from dredging, transport, reuse, disposal, and other construction activities for that project were found to have a less-than-significant cumulative impact. Thus, the BMKV expansion is not expected to result in a cumulative impact on air quality.

The proposed BMKV expansion is not expected to contribute to significant long-term cumulative noise impacts. It would, however, exacerbate existing noise levels at sensitive receptors during construction. These noise levels could be reduced through appropriate construction practices to a less-than-significant level. With mitigation, the BMKV expansion would not be expected to contribute considerably to a cumulative noise impact.

Cultural Resources

Implementation of the proposed BMKV expansion could contribute to a cumulative loss of cultural resources in the region if appropriate mitigation measures are not implemented. However, as described in chapter 4, mitigation measures would be implemented to reduce this impact to a less-than-significant level, and the BMKV expansion is not expected to result in any considerable contribution to a significant cumulative impact on cultural resources.

Aesthetics

As a result of levee construction associated with the restoration alternatives for the BMKV expansion, portions of existing views from residences along parts of the BMK south lagoon may be obstructed, as discussed in the previous chapter. While this is a direct and significant impact of the BMKV expansion (under Alternatives 1 and 3, but not under Revised Alternative 2), there are no other proposed developments in the area of these views. Therefore, this is a project effect and not a cumulative effect. The BPAFRP is located north of the north lagoon and thus any associated aesthetic effects would be in a different location and would be experienced by different recipients than those on the southern portion of the south lagoon. The cumulative effect of implementation of HWRP, including the BMKV expansion, is expected to have a beneficial aesthetic impact in the long term by restoring natural communities to the edge of San Pablo Bay.

Significant and Unavoidable Impacts

For the proposed BMKV expansion, there are several significant impacts that currently proposed mitigation may not mitigate to a less-than-significant level.

The first is the potential for an increase in methylation of mercury. This could occur through tidal wetland processes that deposit on the site dredged materials

or sediments that contain mercury, originating from Novato Creek or San Pablo Bay. The actual potential for this impact to occur is unknown at this time because of the limitations in current scientific understanding of mercury cycling in wetland environments. A scientific study of this specific issue is currently funded and underway through the CALFED program and will be examined through the developing TMDL for mercury in San Francisco Bay. It is proposed that an interagency adaptive management plan be implemented to evaluate the timing, sequencing, and scale of wetland restoration projects in San Pablo Bay and elsewhere in the Bay, as the understanding of this issue advances to the point that reasonable management decisions can be made concerning the progress of wetland restoration projects. However, because scientific understanding of this impact is insufficient to provide a definitive conclusion regarding the significance of the impact and the potential efficacy of mitigation, this impact is currently considered significant and unavoidable.

The offshore off-loading facility and booster-pump platforms for off-loading dredged material may be built on piles that would need to be pile-driven. Pile-driving equipment may produce localized noise that may affect listed fish species and marine mammals in areas immediately adjacent to San Pablo Bay. While population-level impacts are not expected, construction may result in mortality of individual fish and harassment of individual marine mammals present in the immediate vicinity of pile-driving activity. This impact is considered potentially significant. Mitigation is proposed. Even with mitigation, however, there is the potential for individual mortality of listed fish species and harassment of marine mammals immediately adjacent to pile-driving activity. If pile driving were to be used, this impact would be considered significant and unavoidable.

Alternative 1 would include construction of a new outboard levee approximately 1,000 feet east and south of the BMK south lagoon. Under Alternative 1, this levee, initially constructed to a height of approximately 12 feet NGVD (and then settling to 8 feet NGVD over time) would obstruct portions of existing views for southward-facing homes in the southern part of the BMK residential area. Under Revised Alternative 2, the outboard levee would be initially constructed to a height of approximately 10 feet NGVD (and then settle to 8 feet NGVD over time) and would be located further away (about 1,500 feet) from the BMK south lagoon than under Alternative 1. Under Alternative 3, the new levee would be built approximately 50 feet south of the BMK south lagoon and would obstruct existing views from the street level/ground floor for southward-facing homes in the southern part of the BMK residential area. While views would still be mostly available from second-story vantage points and unobstructed views would be available from the Bay Trail and optional spur trail (if built under Alternatives 1 or 3), this is considered a significant unavoidable impact for Alternatives 1 and 3, unless the height and location of the levees were altered as in Alternative 2. Under Revised Alternative 2, with the lowering of the initial construction height of the levees and the relocation of the new outboard levee further away from residential areas, the impacts to aesthetics are expected to be less than significant.

Irreversible and Irretrievable Commitment of Resources

The proposed BMKV expansion would result in the irretrievable commitment of fossil fuels and other energy sources needed to build, operate, and maintain the wetlands. The restoration of the site to wetlands, however, is not considered an irreversible commitment because the landscape could again be converted to other land uses in the future. In sum, the BMKV expansion does not involve converting the land to urban land uses, which tend to be irreversible.

Relationship between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term uses of the environment that would occur with restoration include the impacts on existing wetlands and habitat. As discussed in chapter 4, construction would result in the loss of wetland and upland habitat that presently exists at the BMKV expansion site. However, in the long term, the site is expected to be substantially more productive for fish and wildlife and associated habitat values, through the restoration of tidal wetlands and other habitats on-site.

The timeframes for construction of the different alternatives vary, as does the expected timeframe for the establishment of wetland habitats on the site. Alternatives 1 and 2 both involve the placement of substantial amounts of dredged material, and the overall construction period associated with these alternatives could last up to 13 years. However, a phased approach would be used, allowing completion of restoration activities on individual tidal cells in advance of completion of restoration activities on the entire site, and the first tidal cell may be ready for opening to tidal action approximately 7 to 8 years after commencement of construction. Under Alternatives 1 and 2, low marsh would establish first, with mid/high marsh beginning to establish approximately 10 years after opening the site to tidal action. Therefore, from commencement of construction activities, which would affect existing habitats, mid/high marsh could begin to establish on the first cell approximately 17 to 18 years after commencement of construction. Mid mid/high marsh could begin to establish on the remainder of the site approximately 27 to 28 years after commencement of construction.

Under Alternative 3, the overall construction period would last 5 years, which is less time than under the other 2 alternatives. However, Alternative 3 would rely primarily on natural sedimentation, so wetland would be established much more slowly, with mudflats taking 5 years to establish; low marsh taking 15 years; and mid-marsh taking approximately 40 years. From the commencement of construction, it could take approximately 45 years to establish mid/high marsh.

Thus, there would be a longer gap between the loss of existing habitat and the establishment of restoration habitat under Alternative 3.

Chapter 6
Scoping, Consultation, and Other Requirements

This chapter provides an overview of the scoping process, consultation, and other requirements for the proposed BMKV expansion, as well as describes the progress made in meeting those requirements.

Scoping

The process of determining the scope, focus, and content of an EIR/EIS is known as scoping. The scoping process assists the lead agencies in determining the substantive issues to be addressed in an EIR/EIS. Tools used in scoping for the BMKV expansion included early consultation with governmental agencies and the public, an NOP/NOI, and a scoping meeting.

Through a series of workshops in fall 2002, the lead agencies informally conferred with representatives from the USFWS, DFG, MCFCWCD, NSD, City of Novato, County of Marin, BMK CSD, ABAG/Bay Trail, and local residents.

The NOI/NOP for this SEIR/EIS was published in the Federal Register on November 27, 2001. Agency and public comments received by the Conservancy and the Corps during the scoping process have been assembled in a scoping report, which is included as appendix G.

The Conservancy and the Corps conducted a scoping meeting on December 5, 2001, in Novato, California, near the project site. The comments received at this meeting are summarized in the scoping report.

Key issues of public concern about the proposed BMKV expansion that were identified during the scoping process include the following.

- Flood protection
- Drainage easements and agreements
- Effects on Pacheco Pond
- Public access/Bay Trail alignments
- Novato Creek sedimentation/dredging/navigation

- Levee protection and stability
- Existing wildlife habitats
- Buffers between residential and restoration area
- Compatibility of habitat and access components
- Novato Sanitary District outfall alignment
- Use/quality/handling of dredged material
- Hazardous waste

The lead agencies have also informally conferred with representatives of the aforementioned agencies during the preparation of the Draft SEIR/EIS document through a series of stakeholder meetings, site visits, and agency meetings.

Appendix G describes the public involvement and scoping process and results in greater detail.

The Draft SEIR/EIS was circulated for public comment between July 19, 2002 and September 13, 2002. A separate volume includes the comments received on the Draft SEIR/EIS and the lead agencies' written responses to those comments.

Consultation and Requirements

Federal Endangered Species Act

The USFWS and NMFS administer the federal ESA. The federal ESA maintains a list of threatened and endangered species and provides for substantial protection of the listed species through compliance with Sections 7 and 10 of the federal ESA. NMFS is responsible for the protection of marine mammals and fishes (including anadromous fishes); all other species are within USFWS jurisdiction. Through Section 7 or Section 10 of the federal ESA, USFWS and NMFS ensure that project activities do not result in jeopardy to listed species or adverse modification of critical habitat. Under Section 7 of the federal ESA, a federal agency must ensure that its actions do not jeopardize the continued existence of a listed species and must formally consult with USFWS and NMFS if the proposed action may affect a listed species under either agency's jurisdiction.

The federal lead agency must consult with USFWS and NMFS to assess the consequences of its actions and to determine whether formal consultation is warranted. Formal consultation is initiated by the project proponent upon submission of a written request for consultation and a biological assessment of the proposed action. If USFWS and NMFS conclude that the action is not likely to adversely affect a listed species, then the action may be carried out without further review under the federal ESA. If the action is likely to result in adverse impacts on a listed species, then USFWS and NMFS will prepare a biological

opinion describing how the action will affect the listed species. The opinion will provide either a "jeopardy opinion" or an "incidental take opinion." A *jeopardy opinion* concludes that the proposed action would jeopardize the continued existence of a federally listed species or adversely modify critical habitat of a listed species. Under this finding, the biological opinion must suggest "reasonable and prudent alternatives" that would avoid a jeopardy result. If the proposed actions would result in the take of a listed species, then an "incidental take statement" would be issued. In an *incidental take statement*, USFWS and NMFS must specify the allowable amount of take that may occur as a result of the action, and USFWS and NMFS must suggest mitigation measures that will reduce or avoid impacts and compensate for the take.

The Corps is in formal consultation with USFWS and informal consultation with NMFS regarding the HWRP and the BMKV expansion. USFWS representatives also participated in the design charettes conducted in 2001, as part of the conceptual design. On behalf of the Corps, Jones & Stokes requested a list of threatened, endangered, and candidate species in the project area. USFWS and NMFS responded with several lists of such species, which are included in appendix D. The *Biological Resources* section of chapter 4 describes the potential for listed, proposed, or other sensitive species to occur in the area affected by the alternatives. The Corps is currently preparing a draft Biological Assessment. The Corps also is currently consulting with USFWS and NMFS for both the authorized HWRP and the proposed BMKV expansion to determine the scope of required consultation, identify species of concern, and develop an appropriate approach to addressing listed and proposed species as part of the Section 7 consultation.

National Historic Preservation Act

Federal involvement in the BMKV project triggers the requirement to comply with NHPA Section 106. Compliance with Section 106 requires the Corps to inventory historic properties and evaluate the eligibility of those properties for listing in the NRHP. The effects of the proposed BMKV expansion on properties that may be eligible for listing or are already listed on the NRHP was addressed during that process. The *Cultural Resources* section of chapter 4 describes the potential effects of the restoration alternatives on cultural resources and identifies measures that may be necessary in order to avoid or reduce impacts on these resources. As presented in that section, the proposed project is not expected to result in any significant effects on identified cultural resources, and no NRHP listed eligible or potentially eligible resources would be affected. A Section 106 report is currently being prepared by the Corps and will be submitted to the State Historic Preservation Office for review, as necessary to comply with consultation requirements.

Farmland Protection Policy Act

The Farmland Protection Policy Act (FPPA) of 1981 requires federal agencies to consider project alternatives that minimize or avoid adverse impacts on prime and unique farmland. As described in the *Land Use and Public Utilities* section of chapter 4, farmland will be affected by the restoration alternatives. The No-Action Alternative is the alternative that would best preserve the existing farmland at the site. However, none of this farmland is considered prime and unique farmland or statewide important farmland. Because of the quality of the existing farmland, the overall impact due to its loss through implementation of one of the restoration alternatives is expected to be less than significant. To fulfill the requirements of the FPPA, the Corps will consult with NRCS regarding this farmland.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) requires equal consideration of wildlife resource values in federal water-resource project planning, approval, and implementation. Compliance with the equal consideration mandate requires: consultation between action agencies and wildlife agencies or measures necessary to conserve wildlife in project planning, construction, and operation; reporting by wildlife agencies on the effects of the project and its alternatives upon wildlife resources and on measures recommended to conserve wildlife resources in connection with the project and its alternatives; full consideration by the action agencies of measures recommended to conserve wildlife resources, both with regard to the proposed project and its alternatives; and implementation of justifiable conservation measures.

The Corps, as federal lead, is consulting with USFWS on the preparation of a Coordination Act Report (CAR) for the proposed BMKV expansion. One of the goals is to provide a diverse array of wetland and wildlife habitats at HAAF and BMKV that benefits a number of endangered species and other migratory and resident species, it is expected that, with implementation of any other justifiable conservation measures, the proposed BMKV expansion will be in compliance with the FWCA.

Marine Protection, Research, and Sanctuaries Act

The Marine Protections, Research, and Sanctuaries Act (MPRSA) regulates the ocean dumping of waste, provides for a research program on ocean dumping, and provides for the designation and regulation of marine sanctuaries. Specifically, the act regulates the ocean dumping of all material beyond the territorial limit (3 miles from shore) and prevents or strictly limits dumping material that "would adversely affect human health, welfare, or amenities, or the marine environment,

ecological systems, or economic potentialities" (DOE Office of Environmental Policy and Guidance 2002).

The MPRSA is applied to activities that would directly place or dump materials into the ocean. The proposed wetland restoration project does not involve any of those types of activities. The proposed wetland restoration project involves the use of an off-shore facility that would transport dredged material for placement of dredged materials on land (e.g., on the BMKV expansion site). Therefore, the MPRSA is not applicable to the proposed BMKV expansion project.

Anadromous Fish Conservation Act

The Anadromous Fish Conservation Act (AFCA) (16 U.S.C. 757a-757g; Pub. L. 89-304, as amended) authorizes NMFS (under delegated authority from the Secretary of Commerce and/or the Secretary of Interior) to enter into cooperative agreements to protect anadromous fishery resources and to conserve, develop, and enhance anadromous fisheries.

Pursuant to the agreements authorized under the AFCA, NMFS may (1) conduct investigations, engineering and biological surveys, and research; (2) carry out stream clearance activities; (3) undertake actions to facilitate the fishery resources and their free migration; (4) use fish hatcheries to accomplish the purposes of the act; (5) study and make recommendations regarding the development and management of streams and other bodies of water consistent with the intent of the act; (6) acquire lands or interest therein; (7) accept donations to be used for acquiring or managing lands or interests therein; and (8) administer such lands or interest therein in a manner consistent with the intent of the act. Following the collection of these data, NMFS makes recommendations pertaining to the elimination or reduction of polluting substances detrimental to fish and wildlife in interstate or navigable waterways (National Council for Science and Environment 2002).

The Corps has been informally consulting with NMFS regarding the BMKV expansion and its potential effect on anadromous fishes known to occur within Novato Creek and San Pablo Bay. The Corps will implement the provisions of the AFCA as required by NMFS in order to comply with the AFCA.

Magnuson Fishery Conservation and Management Act

The Magnuson Fishery Conservation and Management Act (MFCMA) (16 U.S.C. 1801-1882; Pub. L. 94-265, amended) established 8 Regional Fishery Management Councils and required these councils to prepare fishery management plans (FMPs) for those fisheries that they determine require active federal management. Part of the preparation of an FMP is to identify "essential

fish habitat" for managed species. The MFCMA requires federal agencies to consult with NMFS to determine potential federal project effects on essential fish habitat (National Council for Science and Environment 2002).

The Corps has been informally consulting with NMFS regarding the BMKV expansion and its potential effects on marine resources. The Corps will prepare an essential fish habitat assessment and submit it to NMFS for review in compliance with the MFCMA.

Executive Order 11988—Floodplain Management

Executive Order 11988, "Floodplain Management," requires federal agencies to prepare floodplain assessments for proposed projects located in or affecting floodplains. An agency proposing to conduct an action in a floodplain must consider alternatives to avoid adverse effects and incompatible development in the floodplain. If the only practicable alternative involves siting in a floodplain, the agency must minimize potential harm to or development in the floodplain and explain why the action is proposed in the floodplain.

As described in the *Surface Water Hydrology and Tidal Hydraulics* section of chapter 4, the entire BMKV expansion site is within the 100-year floodplain due to the subsided elevations of the site and the deterioration of surrounding perimeter levees. Because the objective of the proposed BMKV expansion is to restore tidal wetlands, the area within the expansion boundaries would be flooded. Secondary impacts involving the potential for flooding surrounding parcels as a result of the proposed BMKV expansion are addressed by design features included in the restoration alternatives and are discussed in the *Surface-Water Hydrology* section of chapter 4. This SEIR/EIS concludes that, through restoration design and implementation of mitigation measures, the BMKV expansion will not increase the potential for flooding on surrounding parcels.

Executive Order 11990—Protection of Wetlands

Executive Order 11990, "Protection of Wetlands," requires federal agencies to prepare wetland assessments for projects located in or affecting wetlands. Agencies must avoid undertaking new construction in wetlands unless no practicable alternative is available and the proposed action includes all practicable measures to minimize harm to wetlands.

One of the primary goals of the proposed BMKV expansion is to restore wetlands in the HAAF, SLC, and BMKV parcels. As described in the *Biological Resources* section of chapter 4, the expansion would result in the loss of some of the existing tidal wetlands outside the perimeter levees and all of the existing wetlands within the perimeter levees. However, this loss would be substantially offset by the creation of both tidal wetland and seasonal wetlands under all the restoration alternatives. By returning the site to tidal action and favoring the

ultimate formation of tidal wetlands, the end result of the proposed BMKV expansion would be a net benefit to the wetland ecosystems of the expansion site, Novato Creek, and San Pablo Bay.

Executive Order 12898—Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations," requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their actions on minorities and low-income populations and communities. No permanent or temporary residences are located on the BMKV site. The adjacent residential area, Bel Marin Keys, is not a minority or low-income community. The analysis in chapter 4 did not identify any impacts of the proposed project on the neighboring residential area that could not be mitigated to a less-than-significant level with implementation of the preferred alternative and the proposed mitigation. Thus no disproportionately high or adverse human health or environmental effects on minority or low-income populations has been identified.

Chapter 7

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This Final SEIR/EIS is being distributed to federal, state, and local agencies with jurisdictional authority, permit authority, or interest in the project. The Final SEIR/EIS is also being made available to individuals and organizations who commented on the Draft SEIR/EIS. Notices of availability of this document are being distributed to organizations and individuals located within close proximity to the project or that have been identified as potentially concerned or interested parties within the project area. Organizations receiving notice are listed below, but individuals are not. The document is also available at local libraries and on the Internet at http://www.coastalconservancy.ca.gov/belmarin/index.html

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U.S. Army, Base Realignment and Closure Environmental Office, Hamilton Army Airfield

U.S. Coast Guard

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City of San Rafael Planning Department

Las Gallinas Sanitation District

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Bel Marin Keys Parks Committee

Benevolent and Protective Order of the Elks, Novato

Black Point Environmental Association

Black Point Improvement Club

California Native Plant Society - Marin Chapter

California Native Plant Society

Catholic Youth Organization

Catholic Youth Organization - St. Vincent

Church of the Nazarene

Citizen's Committee to Complete the Refuge

Coastal America

Communities for a Better Environment

East Novato Neighborhood Association

Environmental Forum of Marin

Federated Coast Miwok

Friends of Novato Creek

Hamilton Field Action Association

Hamilton Field Community Development Foundation

Hamilton MAB

Hamilton Reuse Committee

Ignacio Rotary

Kiwanis Club of Novato

Knights of Columbus, Novato

League of Women Voters of Marin County

Los Robles Mobile Home Park Association

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The text, figures, and appendices of the Final SEIR/EIS are available online in PDF format at: http:// www.coastalconservancy.ca.gov/belmarin.

Chapter 8
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Chapter 9
Acronyms and Abbreviations

ABAG	Association of Bay Area Governments
AFCA	Anadromous Fish Conservation Act
ACHP	Advisory Council on Historic Preservation
ADEC	San Francisco International Airport's Airfield Development Engineering Consultant
APE	Area of Potential Effect
ASR	Archives Search Report
ATSDR	Agency for Toxic Substances & Disease Registry
BAAQMD	Bay Area Air Quality Management District
Basin Plans	Water Quality Control Plans
Bay–Delta	San Francisco Bay/Sacramento–San Joaquin River Delta
BCDC	San Francisco Bay Conservation and Development Commission
BFC Zone	Bayfront Conservation Zone
BFE	base flood elevations
BMK	Bel Marin Keys
BMK CSD	Bel Marin Keys Community Services District
BMKV	Bel Marin Keys Unit V
BPAFRP	Black Point Antenna Field Restoration Project
Cal-EPA	California EPA
CALFED	CALFED Bay–Delta Program
Calpak	California Packing Corporation
CAP	Clean Air Plan
CAR	Coordination Act Report
CARB	California Air Resources Board
CCMP	Conservation and Management Plan
CCR	California Code of Regulations
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
Cfs	Cubic Feet per Second
CMP	Coastal Management Plan
CNPS	California Native Plant Protection Act
CO	Carbon Monoxide

Conservancy	California State Coastal Conservancy
Corps	U.S. Army of Engineers Corps of Engineers
CRHR	California Register of Historical Resources
CSD	Community Services District
CTR	California Toxics Rule
CWA	Clean Water Act
dB	Decibels
dBA	A-weighted Decibels
DERP	Defense Environmental Restoration Program
DFG	California Department of Fish and Game
DMMO	Dredged Material Management Office
DOC	Department of Conservation
DoD	Department of Defense
DTSC	Department of Toxic Substances Control
DWR	California Department of Water Resources
East Span Project	San Francisco–Oakland Bay Bridge East Span Seismic Safety Project
EBEP	Enclosed Bays and Estuaries Plan
EHT	Extreme High Tide
EIR	Environmental Impact Report
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FMP	fishery management plan
FPPA	Farmland Protection Policy Act
FUDS	Formerly Used Defense Site
FWCA	Fish and Wildlife Coordination Act
FIRM	Flood Insurance Rate Map
FIS	flood insurance study
FFS	Focused Feasibility Study Report
FNC	Friends of Novato Creek
GGBHTD	Golden Gate Bridge Highway Transit District
Goals Project	San Francisco Bay Area Wetlands Ecosystem Goals Project
GRR	General Reevaluation Report
HAAF	Hamilton Army Airfield
HEP	Habitat Equivalency Procedure
HWRP	Hamilton Wetland Restoration Project

IAR	Initial Appraisal Report
IFI	Important Farmland Inventory
kJ	Kilojoules
LESA	Land Evaluation and Site Assessment
LIDAR	Light Detection and Ranging
LOS	Level of Service
LTMS	Long-Term Management Strategy for Disposal of Dredged Material in the San Francisco Bay Region
M	Magnitude
MAD	Mosquito Abatement District
MCCDA	Marin County Community Development Agency
MCFCWCD	Marin County Flood Control and Water Conservation District
mcy	million cubic yards
MFCMA	Magnuson Fishery Conservation and Management Act
mg/l	Milligram/liter
MHHW	Mean Higher High Water
MHW	Mean High Water
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MAMP	Monitoring and Adaptive Management Plan
MOA	Memorandum of Agreement
mph	Miles per Hour
MPRSA	Marine Protections, Research, and Sanctuaries Act
MSL	Mean Sea Level
MSMAD	Marin-Sonoma Mosquito Abatement District
MTL	Mean Tide Level
NAF	North Antennae Field
NAHC	Native America Heritage Commission
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NHPA	National Historical Preservation Act
NMFS	National Marine Fisheries Service
NMWD	North Marin Water District
NO_2	Nitrogen Dioxide
NOAA/NOS	National Oceanic & Atmospheric Administration /National Ocean Survey
NOI	Notice of Intent
NOP	Notice of Preparation
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPRR	Northwestern Pacific Railroad

NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSD	Novato Sanitary District
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCWQCA	Porter-Cologne Water Quality Control Act
PDD	perimeter drainage ditch
PIDP	Pile Installation Demonstration Project
PM0	Particulate Matter Less than 0 microns in Diameter
PM10	Particulate Matter Less than 10 microns in Diameter
ppm	Parts per Million
PRG	Premlininary Remediation Goal
RCRA	Resource Conservation and Recovery Act
RCD	Resource Conservation District
ROD/RAP	Record of Decision/Remedial Action Plan
ROG	Reactive Organic Gases
RWQCB	Regional Water Quality Control Board
SCR	Selective Catalytic Reduction
SEIR/EIS	Supplemental Environmental Impact Report/Environmental Impact Statement
SF RWQCB	San Francisco Regional Water Quality Control Board
SFBAAB	San Francisco Bay Area Air Basin
SFHA	special flood hazard area
SHPO	State Historic Preservation Officer
SIPs	State Implementation Plans
SLC	State Lands Commission
SO_2	Sulfur Dioxide
SPL	Sound Pressure Level
SVOC	semi-volatile organic compound
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
WDR	Waste Discharge Requirement
Williamson Act	California Farmland Protection Act
WRDA	Water Resources Development Act

Appendix A

Selected Pages from Hamilton Wetland Restoration Project EIS/EIR Project Description

Chapter 3. Project Alternatives under Consideration

Introduction

Coastal Conservancy staff, BCDC staff, and the Corps are proposing to restore wetlands at HAAF and the adjacent SLC parcel (Figure 3-1). A 20-acre site owned by the U.S. Navy, which is frequently referred to as the Navy ballfield, is located in the southwest corner of the HAAF parcel. The following discussion and impact analysis includes the Navy ballfield as part of the HAAF parcel.

The project objectives described in Chapter 2 could be attained by restoring wetlands either through the process of natural sedimentation or by actively placing dredged materials on the site. Four wetland restoration alternatives are evaluated in this EIR/EIS. These alternatives include restoration of wetlands in the following areas by the following means:

- HAAF parcel by natural sedimentation (Alternative 2),
- HAAF parce' using dredged material (Alternative 3),
- HAAF and SLC parcels by natural sedimentation (Alternative 4), and
- HAAF and SLC parcels using dredged material (Alternative 5).

Alternative 1: No Action, also described in this EIR/EIS, serves as the baseline condition for evaluating environmental impacts of the other alternatives.

The four project alternatives have been evaluated at an equal level of detail. Coastal Conservancy staff and the Corps have identified Alternative 5 as the preferred alternative because it best meets the project goal and objectives. Under Alternative 5, the use of dredged material would reduce the amount of time necessary for the restored wetlands to become fully functional, the use of dredged material for restoration would help reduce the amount of dredged material that could be disposed of in the bay or the ocean, and maintenance requirements would be lower than under alternatives that do not rely on dredged material.

Project Background

The Hamilton wetland restoration project could include the HAAF and SLC parcels. This section provides information on the current status of each parcel and how these parcels would be integrated into the wetland restoration project.

Hamilton Army Airfield Parcel

Defense Base Closure and Realignment Act of 1988

HAAF is currently owned by the Department of Defense (DoD) and most recently served as a subinstallation to the Presidio of San Francisco (Figure 3-2). BRAC directed DoD to close and dispose of HAAF. Accordingly, the Army evaluated the environmental impacts of disposal and reuse of HAAF in an EIS completed in 1996. A record of decision on disposal and reuse was prepared by the Army in 1997.

Three alternatives were evaluated in the Army's disposal and reuse EIS: no action, disposal without encumbrances, and disposal with encumbrances. The Army identified disposal with encumbrances as its preferred alternative. The record of decision indicates that, as part of the disposal process at HAAF, the Army presently requires new owners to maintain these encumbrances, including maintenance of the Landfill 26 wetland mitigation site, continuation of access easements provided to the Novato Sanitary District (NSD) and the SLC, and provision of a perpetual easement for a flood control levee granted to the New Hamilton Partnership. In addition to these encumbrances, the Army also requires new owners to maintain flood control infrastructure until the new landowner's reuse plan has met all consultation, regulatory, and permitting requirements and has identified a way to control human access to the outboard tidal marsh. <u>However, some of these encumbrances may be modified or eliminated as a result of changed circumstances or actions taken by the Army to meet the conditions of transfer.</u>

Although reuse was not part of the Army's action of disposal, the EIS also disclosed impacts that could occur as a result of the reuse of HAAF. Reuse scenarios evaluated in the EIS included mixed-use development, institutional development, open space with constructed wetland restoration, and open water with natural wetland formation. The reuse scenarios that the Army considered in the EIS were based on the local reuse planning efforts of the City through the Hamilton Reuse Commission (HRC) appointed by the Novato City Council. The HRC's preferred uses of HAAF were wetlands, wetlands with other uses, and low-density mixed-use development. The record of decision for the disposal and reuse EIS did not indicate a preferred reuse scenario and indicated that evaluation and approval of an official reuse plan would be the responsibility of local planning authorities. The Army is committed to clean up HAAF for the purpose of wetland restoration and will continue to pursue the necessary agreements to ensure transfer of HAAF to the Coastal Conservancy.

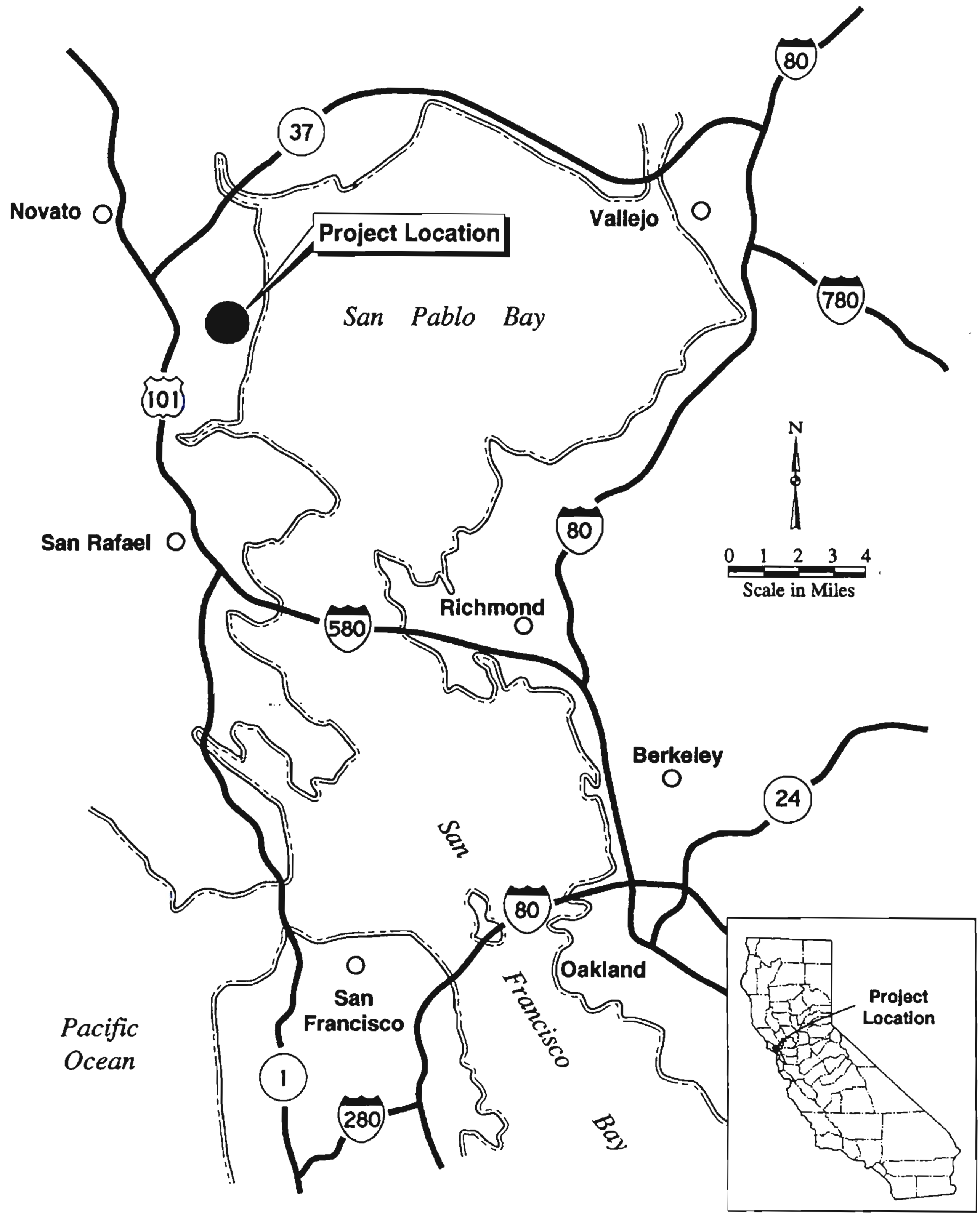

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Figure 3-1
Regional Location of the Hamilton Wetland Restoration Project

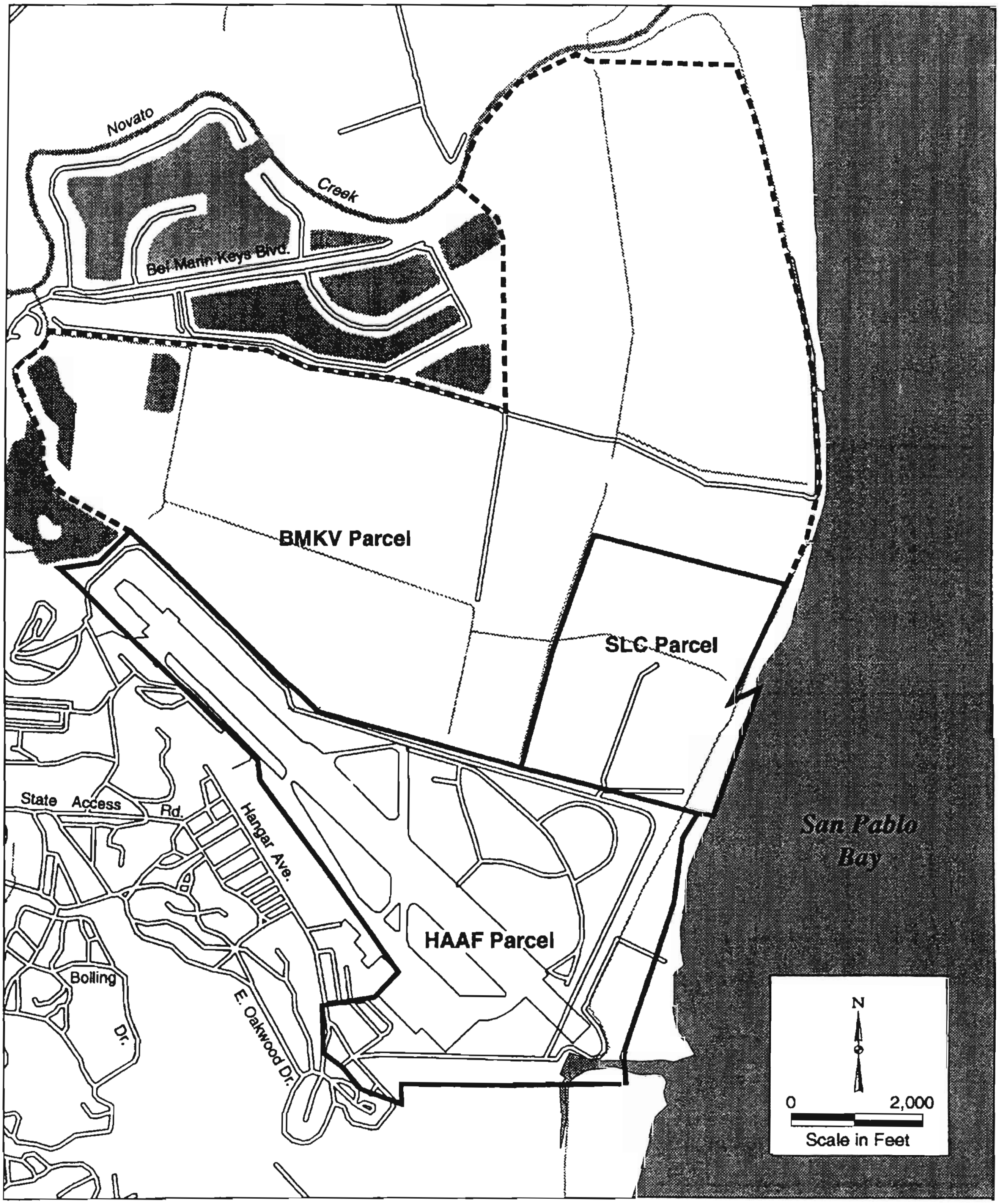

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Figure 3-2
Hamilton Wetland Restoration Project Site

Local Reuse Plan

After the Army completed the EIS on the disposal and reuse of HAAF, the City adopted a reuse plan for the former Hamilton Air Force Base. The reuse plan included HAAF and indicated a preferred reuse of the area as open space and wetlands. The reuse plan established goals and policies for planning areas throughout the former Hamilton Air Force Base, including the HAAF parcel. The plan identified development of wetlands as the goal for reuse of the HAAF parcel.

The reuse plan eliminated from consideration other uses of the HAAF parcel, such as residential or commercial development and aviation. Because these uses have been addressed previously, the environmental impact analysis contained in this EIR/EIS is focused on evaluating restoration of wetlands in the HAAF and SLC parcels (Hamilton Local Reuse Authority 1996).

State Lands Commission Parcel

The area known as Antenna Field, or the SLC parcel, was transferred to the SLC as part of the closure of Hamilton Air Force Base. Communications facilities were previously constructed on the parcel by the Air Force (Figure 3-2). The Air Force also granted an easement over the parcel to the NSD for access to wastewater dechlorination facilities. No reuse plan has been developed for the SLC parcel.

The SLC parcel will not be transferred to the Coastal Conservancy as part of the Hamilton wetland restoration project. It will be included in the restoration project only if it is remediated to a level suitable for wetland restoration.

Hamilton Wetlands Conceptual Restoration Plan

The description of alternatives evaluated in this EIR/EIS is based on the concepts developed in the draft Hamilton Wetlands Conceptual Restoration Plan (Woodward-Clyde 1998) prepared for the Coastal Conservancy and BCDC. The plan provides detailed information on restoration of wetlands on the HAAF and SLC parcels through natural sedimentation and using dredged materials. The plan served as the primary information source for the following description of alternatives and is hereby incorporated by reference into this EIR/EIS. A copy of the executive summary of the plan is included as Appendix A.

Conditions for Transfer

The EIR/EIS assumes that certain management issues associated with the HAAF parcel would be resolved before the Army transfers the parcel to the Coastal Conservancy. These issues include providing an access route to the HAAF parcel, addressing flooding and drainage issues, and remediating contaminated areas. Existing buildings would be removed by the Army if necessary to remediate contaminated areas.

Access

Access to the wetland restoration site would be provided by an easement over existing and new roads through the General Services Administration (GSA) Sale Parcel at HAAF. The road would connect Nave Drive and Perimeter Road and would serve as the primary access route to the restoration site during the construction phase and for monitoring and caretaking purposes once the construction phase is completed. The road would also serve as access to the NSD outfall pipeline and the SLC parcel. The proposed alignment for the access route is shown in Figure 3-3.

Flood Control and Drainage

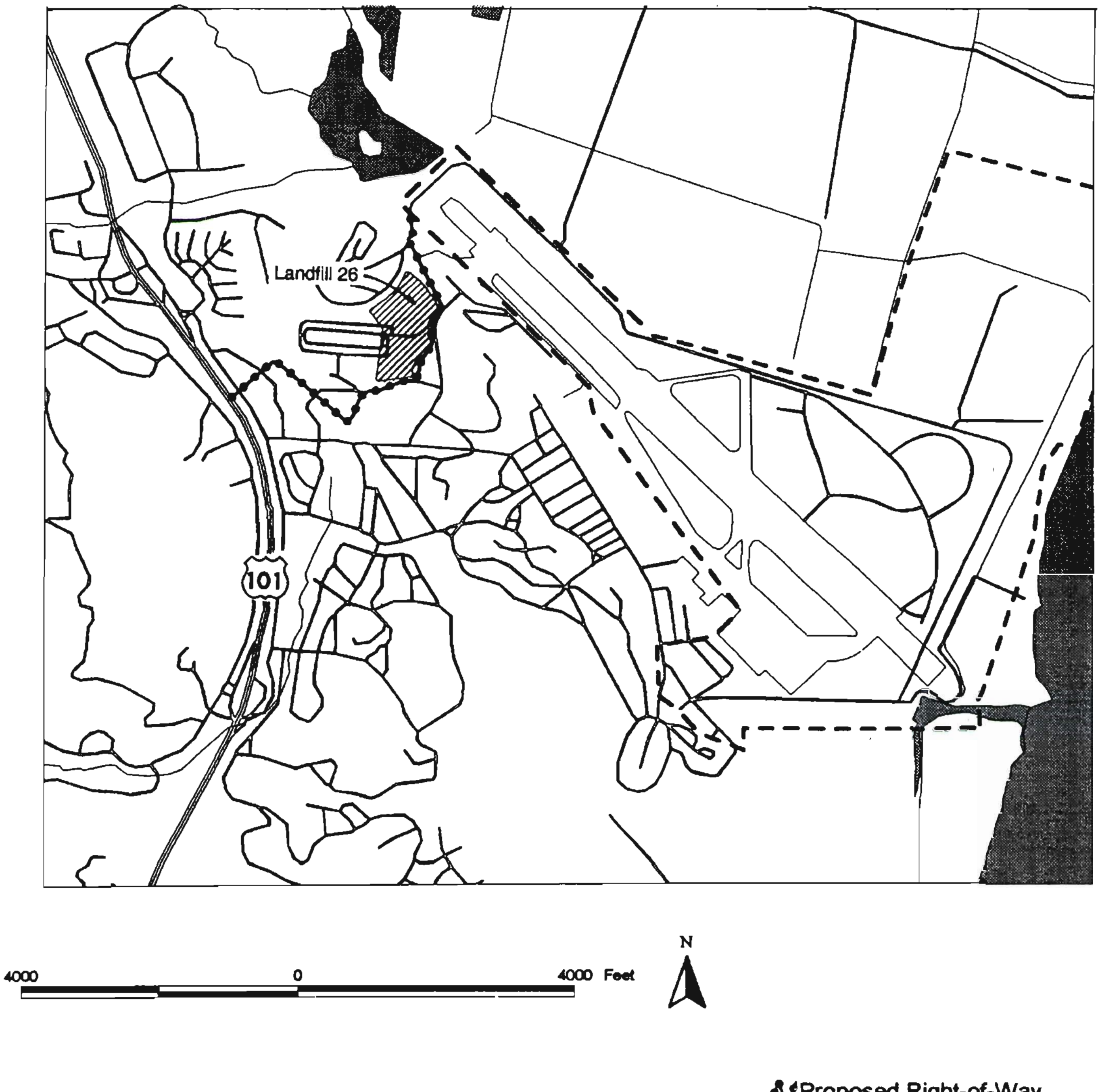
The flood control and drainage facilities in the HAAF parcel affect the hydrologic characteristics of surrounding properties, including the New Hamilton Partnership development, the St. Vincent's and Las Gallinas Sanitary District properties, the Bel Marin Keys Unit V (BMKV) development parcel, Landfill 26, Ignacio Reservoir, and the SLC parcel (Figure 3-4). The Coastal Conservancy has indicated that before its acceptance of the HAAF parcel, existing flood control and drainage issues between the Army and surrounding landowners would be resolved. ~~Methods to resolve these issues could include the following:~~

- ~~modification of storm drainage flows from the St. Vincent's and Las Gallinas Sanitary District properties,~~
- ~~identification and implementation of measures to address ponding of water at Landfill 26, and~~
- ~~discontinuance of surface flows from the BMKV parcel to the HAAF parcel.~~

The Army's goal is to resolve flooding and drainage issues with surrounding properties so that flooding and drainage characteristics of parcels surrounding the HAAF parcel are not adversely affected as a result of base closure. To ensure that closure of the HAAF parcel would not affect these flooding and drainage characteristics, the Army has committed to making modifications to the drainage facilities of the surrounding parcels: the St. Vincent's, Las Gallinas Sanitary District, and U.S. Navy properties; Landfill 26; the SLC parcel; and the BMKV development parcel.

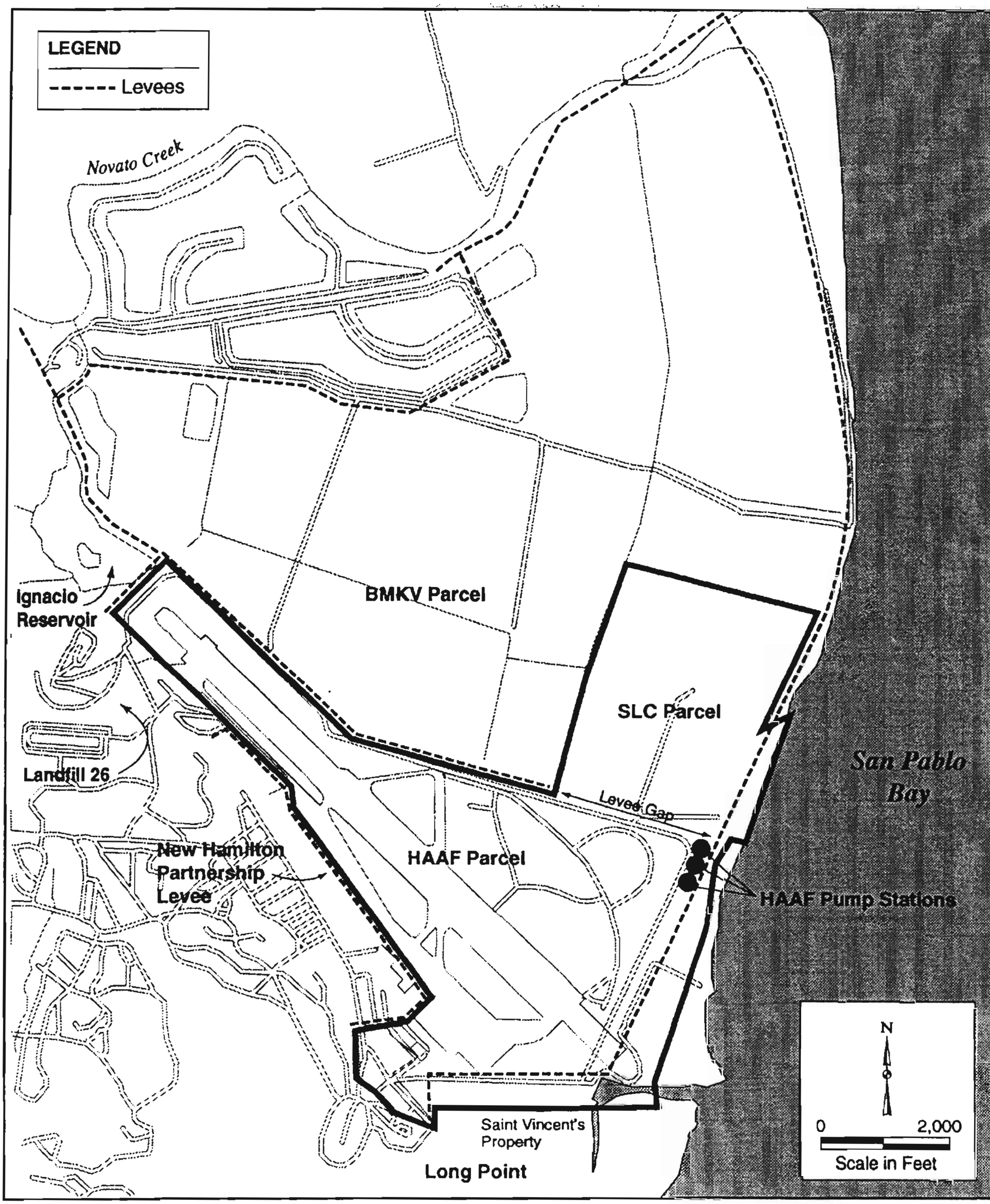
The Army has agreed to address these drainage issues as part of the closure of HAAF. It has indicated that it will undertake any additional environmental impact analysis that may be required to implement these solutions before transfer of the HAAF parcel. A copy of a recent letter to the Coastal Conservancy from the Army describing these commitments is included in Appendix B of this EIR/EIS.

St. Vincent's, Las Gallinas Sanitary District, and U.S. Navy Properties



Jones & Stokes Associates, Inc.

Figure 3-3
Proposed Access Route to the Hamilton Wetland Restoration Project Site



SOURCE:
U.S. Army Corps of Engineers 1996a.

Figure 3-4
Existing Levees and Adjacent Land Uses

The Army proposes to permanently close the slide gate on the canal that currently drains these properties onto the HAAF parcel. The existing St. Vincent's pump station is currently being repaired and upgraded so that it will be able to accommodate any additional drainage onto the St. Vincent's parcel resulting from closing the slide gate. The Army will pay for a portion of the cost to repair and upgrade the St. Vincent's pump station. This drainage would be redirected to the upgraded pump station being constructed by St. Vincent's and managed by the Las Gallinas Sanitary District.

Landfill 26

The Army proposes to construct a pump station to convey water from Landfill 26 and the surrounding area to the HAAF parcel. The discharge will be placed at an elevation that allows for gravity drainage through the proposed wetland restoration project. The Army and the City of Novato are negotiating an agreement stating that the City will maintain and operate the pump station as a condition of using Landfill 26 for recreation purposes. The resolution of this issue is pending formal response from the City to accept and manage the pump station.

State Lands Commission Parcel

As part of the original transfer of the "antenna field" from the Army to the SLC, the Army reserved the right to block the drainage of surface water from the SLC parcel onto the HAAF parcel. This right will be transferred to the Coastal Conservancy as part of the transfer of the HAAF parcel.

Bel Marin Keys Unit V Parcel

Three 30-inch-diameter corrugated steel pipes run through the perimeter levee that separates the HAAF parcel from the BMKV parcel. The pipes are plugged and do not provide drainage between the HAAF and BMKV parcels. The Army is working with the owner of the BMKV parcel to resolve this issue and is determining the function of the drainage. It is the Army's intent to obtain approval from the landowner to permanently block the culverts without making modification to the BMKV parcel drainage system. If this agreement is not reached, the Army will undertake the additional steps necessary to secure approval of the adjacent landowner to permanently block the drainpipes.

The EIR/EIS discloses hydrologic impacts that are directly attributable to restoration of wetlands in the HAAF and SLC parcels.

Flood control for the New Hamilton Partnership development has been resolved through construction of a flood control levee between the development and the HAAF parcel. The new levee and pumping facilities provide adequate flood protection and drainage for the new development. Drainage from the development would continue to be discharged to the restored wetlands.

Structures

Structures remaining in the HAAF parcel include three buildings; three pump stations and the associated drainage ditches; miscellaneous structures, such as runway landing lights and small outbuildings; and the main runway, taxiways, and aircraft parking areas. The EIR/EIS assumes that the Army would leave in place the main runway, taxiways, and aircraft parking areas and those facilities needed by the Coastal Conservancy until the bayward levee is breached. The Army would remove buildings from the HAAF parcel if necessary to remediate contaminated areas.

Process by Which the Site Is Being Remediated

Several federal and state agencies have regulations that govern the use, generation, transport, and disposal of hazardous substances. The principal federal regulatory agency is EPA. The primary state agency in California with similar authority and responsibility is the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances (DTSC), which may delegate enforcement authority to other local agencies. Federal regulations applicable to hazardous substances are contained primarily in Titles 29, 40, and 49 of the Code of Federal Regulations (CFR). State regulations have been consolidated into California Code of Regulations (CCR) Title 26.

This subsection describes the governing agencies responsible for oversight and cleanup of hazardous substances at the HAAF and SLC sites.

HAAF Parcel

CERCLA. The identification, decontamination, and disposal of hazardous waste at HAAF is regulated by the Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); CCR Titles 22 and 23; and all applicable or relevant appropriate requirements (ARARs). The Army is responsible for the cleanup process and performs the cleanup with funding provided through BRAC (Public Law 100-526). The DTSC is the lead agency for regulatory enforcement and oversight of those cleanup activities; however, the Army also must submit findings regarding the effectiveness of the cleanup to EPA and the San Francisco Bay RWQCB.

Any transfer of property must be accompanied by a Finding of Suitability for Transfer (FOST) issued by the Army. A FOST is issued when a property has been determined to be environmentally suitable for transfer. CERCLA Section 120(h)(3) identifies the requirements for environmental suitability.

Regardless of the assessment and cleanup methods used by the Army, the ultimate condition of contaminated areas of HAAF must comply with regulatory cleanup levels established on the basis of the reuse plan for the property. Under certain circumstances, a FOST can be issued for a property with ongoing remediation of previous contamination when CERCLA Section 120(h)(3) requirements have been met, the proposed land use (e.g., wetlands) is compatible with the environmental condition of the

property, no additional public or environmental health risk exists, and issuing such a finding does not interfere with the ongoing action, which is the proposed wetland restoration project.

The BRAC parcel at HAAF is not on the National Priorities List of contaminated sites requiring cleanup. A decision was made to pursue a programmatic approach for cleanup based on EPA's Guidance on Conducting Time-Critical Removal Actions under CERCLA (U.S. Army Corps of Engineers 1998b).

The BRAC parcel will be cleaned up under a sequence of regulatory phases. The Army identified the nature and extent of contamination during a series of assessments and investigations culminating in the Comprehensive Remedial Investigation Report (U.S. Army Corps of Engineers 1998c). Based on those investigations, site-specific removal actions during 1998 and 1999 will be used to clean up contamination to preliminary screening levels recommended by oversight regulatory agencies. A combination of confirmatory sampling, toxicity testing, and ecological and human health risk assessments will provide information used to determine final cleanup goals (remedial action objectives) in a focused feasibility study during 1999. It is intended that all remedial action required to meet those goals will be completed during the removal and confirmatory stages of fieldwork, leading to an environmental Record of Decision that does not require further work; however, if necessary, further remediation will be taken to meet final cleanup goals.

As part of the BRAC process, the Army is planning or conducting activities at sites to address contaminated soils at these sites. Sites affected by petroleum hydrocarbons include underground storage tanks at buildings 15, 20, 35, and 41; the east levee tank pad; the former sewage treatment plant sludge-drying beds; the perimeter stormwater drainage ditch; and the former aircraft revetment that was used for firefighter training activities. Sites with electrical transformers include the east levee boat dock and buildings 82, 92, and 94. These sites are shown in Figure 1, Appendix B.

Soil removal and treatment guidelines for the sites at the HAAF parcel were recommended by regulatory agencies. The soil removal and treatment guidelines are consistent with the proposed restoration of wetlands at HAAF. For all nonpetroleum chemicals of interest, guidance levels are ER-Ms derived from Long 1991 and Long et al. 1995. Guidelines for petroleum chemicals of interest, including TPH-purgeable, TPH-extractable, and BTEX, are based on RWQCB standards (Regional Water Quality Control Board 1995).

Other Concerns. Although petroleum hydrocarbons are not covered by CERCLA, cleanup of these substances is being addressed through the state oversight process. Concerns have been raised about asphalt proposed to be left in place because it contains polyaromatic hydrocarbons (PAHs).

Asphalt contains high-molecular-weight PAHs, which are the least toxic fraction of this class of chemicals. Further, these PAHs are tightly bound in the matrix of the asphalt. For these reasons, weathered asphalt does not pose a significant toxicity risk from PAHs and can be used widely in the environment with little concern. The asphalt in the wetlands project will be buried under sediments and therefore will not be exposed to significant tidal action, which potentially could grind up the asphalt and increase bioavailability. Those areas where asphalt would interfere with tidal channels forming on the site will be removed before dredged material is placed.

Because of the depth of sediments to be placed over the tidal portions of the site, ingestion or bioturbation by benthic infauna also is not expected to be a problem. More than 6 feet of dredged

material will be placed, on average, over the existing substrate and asphalt in the tidal areas. Sedimentation will then increase the depth of cover. Therefore, even if the asphalt were broken up substantially because of the weight of emplaced dredged material and presents more surface area, it will not be exposed to benthic organisms. The only remaining contaminant pathway is through groundwater. High-molecular-weight PAHs have very low solubility, particularly in the low-oxygen groundwater environment in the marsh. Therefore, there is little risk that these tightly bound PAHs in the asphalt would contaminate groundwater, even if the asphalt cracks and presents more surface area because of the weight of emplaced dredged material.

The buildings planned for removal may contain lead-based paint or asbestos or both. The Army has agreed to remove any asbestos found in the buildings. The Corps and Coastal Conservancy plan to remove any lead-based paint in conjunction with the removal of buildings.

SLC Parcel

The SLC parcel was owned by the Air Force and was operated as part of Hamilton Air Force Base until 1974. While the base was in active use by the Air Force, the parcel was used for a variety of purposes, including a rifle range, a pistol range, skeet shooting, firefighting training, and as a communication facility with a number of large antennae. Following the decommissioning of Hamilton Air Force Base, the State of California acquired the parcel and leased a portion of the rifle range to the City of Novato Police Department for small-arms training.

Because ownership of the SLC parcel was transferred from the U.S. Department of Defense (DoD) in 1974, environmental cleanup falls under the Formerly Used Defense Site (FUDS) program. The FUDS program, an element of the Defense Environmental Restoration Program (DERP) (10 USC 2701 et seq.), requires remediation of contaminated sites consistent with CERCLA. The objective of the FUDS program is to reduce, as swiftly and cost-effectively as possible, the risk to human health, safety, and the environment resulting from past DoD activities. Apportionment of liability for contamination associated with the subsequent property owner, or third parties, is addressed through the Potentially Responsible Party (PRP) component of the DERP FUDS process. The goal of the PRP process is to negotiate a fair and equitable settlement that represents DoD's responsibility for contamination at a property.

The SLC parcel is currently in the preliminary assessment/site investigation portion of the CERCLA process. This investigation includes the rifle range, which is a PRP site. Subsequent investigation of the SLC parcel will be conducted, if necessary, during a remedial investigation. The remedial cleanup values developed for the HAAF parcel also will be used for the SLC parcel because the contaminants, geology, and anticipated future land use are similar for both parcels. An interim removal action is planned for the conclusion of the site investigation. This interim removal action will include the rifle range if PRP negotiations have resulted in a settlement. After a Record of Decision is agreed to by DoD and federal and state regulators, any remaining cleanup will be conducted.

Level to Which the Site Will Be Cleaned

As committed to by the Army, the sites will be remediated to a level suitable for wetland restoration as determined by the regulatory agencies overseeing the cleanup of the HAAF and SLC parcels. This remediation will exceed the CERCLA requirements for base closure by taking into account the impacts of any contaminants or other site conditions in the context of the proposed breach of the bayfront levees and other wetland restoration activities; it will include the elimination or reduction of potential impacts from asbestos, pesticides, or petroleum products found onsite. An ecological risk assessment will be used to set the acceptable levels for contamination, and soil bioassays will be used to determine toxicity. As stated previously, these cleanup activities are being conducted as part of an ongoing regulatory process that includes public review.

HAAF Disposal and Reuse EIS Encumbrances

Certain encumbrances and mitigation measures were identified in the Army's record of decision on the HAAF disposal and reuse EIS, including the following:

- u maintenance of the Landfill 26 wetland mitigation site,
- u an access easement over HAAF to the NSD outfall and dechlorination plant,
- u an access easement over HAAF to the SLC parcel,
- u an easement on the HAAF parcel to construct the New Hamilton Partnership perimeter levee, and
- u control of human access to the salt marsh to protect endangered species.

Implementation of the wetland restoration plan would result in filling the Landfill 26 wetland mitigation site. Before proceeding with this modification, the Coastal Conservancy would secure approval by the California Regional Water Quality Control Board (RWQCB) to modify the waste discharge requirement (Order 92-029) under which the wetlands were constructed.

The Coastal Conservancy would continue to provide easements to the NSD for access to the outfall pipeline and to the SLC for access to the SLC parcel. The requirement for access to the SLC parcel would no longer be an issue if the SLC parcel were incorporated into the wetland restoration project, as is expected under Alternative 4 or 5.

The easement on the HAAF parcel to construct the New Hamilton Partnership perimeter levee would be conveyed to the ~~Coastal Conservancy~~ City of Novato~~, and~~. The City of Novato also would take title to the underlying fee interest of the perimeter levee. In addition, the City would convey an easement to the Coastal Conservancy to allow flooding and surcharge on the HAAF parcel side of the levee. ~~the~~ The wetland restoration plan does not provide for uncontrolled public access to the salt marsh.

Alternative 1: No Action

Alternative 5: Restoration of Wetlands in the HAAF and SLC Parcels Using Dredged Material

Under Alternative 5, wetlands would be restored in the HAAF and SLC parcels using dredged material and natural sedimentation. Before dredged material is placed in the area, perimeter levees would be constructed and the bayward levee would be breached. Although wetlands on both parcels would be restored, the parcels would not be hydrologically connected because of the need to maintain operation of and access to the NSD outfall pipeline. Internal peninsulas designed to reduce wave erosion would be constructed on the HAAF parcel only. On the SLC parcel, additional material would be placed along perimeter levees to offset wave erosion.

Restoration Targets

Since publication of the draft EIR/EIS, the Army has indicated that the transfer of the HAAF parcel could be modified to include a portion of the area between Landfill 26 and the present western boundary of the wetland restoration site. This area occupies approximately 14 acres and would be restored as seasonal wetlands. Because the area is currently disturbed, the Coastal Conservancy and the Corps have concluded that expanding the project to include this site is not expected to result in significant adverse environmental impacts beyond those evaluated in the following chapters. Moving the boundary of the wetland restoration project east is not expected to affect the Army's plans for addressing the issue of drainage from Landfill 26.

Including this area in the project could increase the benefits associated with the wetland restoration project and decrease site preparation costs. Wildlife dependent on seasonal wetland habitat also would benefit because the acreage of this habitat type would increase. Levee construction costs would be expected to decrease because an existing levee would form the western boundary of the restoration project. For the purposes of the following impact evaluation, the project size, habitat types and acreage, and the length of new and reconstructed levees have not changed from those evaluated in the draft EIR/EIS.

The ultimate objective of a fully functioning wetland restoration project under Alternative 5 is to create tidal coastal salt marsh, seasonal wetlands, tidal pannes, and grasslands. The acreage of each habitat type created or enhanced under Alternative 5 is shown in Table 3-1. The estimated rates at which these habitat types are expected to form under Alternative 5 are shown in Figures 3-5a, 3-5b, and 3-5c. As under Alternative 4, the predominant habitat types would be tidal coastal salt marsh and seasonal wetland. In addition, establishment of tidal pannes in the HAAF parcel is an objective of Alternative 5, similar to Alternative 3. The distribution of habitat types in the restored wetlands is shown in Figure 3-14.

Restoration of these habitats under Alternative 5 is expected to provide benefits for special-status species that use San Pablo Bay similar to those described under Alternatives 2 and 3 when the restoration has evolved to maturity. Because a substantially larger area of tidal coastal salt marsh would be restored, however, the magnitude of benefits to these species is also expected to be substantially greater. Like Alternative 3, the restored coastal marsh community under Alternative 5, however, would more closely resemble the coastal salt marsh communities historically present in San Pablo Bay than under Alternative 4 because tidal pannes would be created under Alternative 5. The area of tidal marsh and aquatic habitats that would be restored under Alternative 5 is similar to that expected to be restored under Alternative 4 once the restoration has evolved to maturity. Coastal salt marsh habitat areas, however, are also expected to establish more rapidly under Alternative 5; consequently, more habitat area would be available for species dependent on coastal salt marsh and less habitat area would be available for species dependent on subtidal and intertidal aquatic habitats during the period when the restoration is evolving than under Alternative 5. As described for Alternative 4, the total area of tidal marsh and aquatic habitats restored under Alternative 5 would be more than the area that would be restored under Alternatives 2 and 3.

Although the total acreage of the restoration project would be the same under Alternative 5 as under Alternative 4, the habitat types restored under Alternative 5 would be more diverse because of the addition of tidal pannes. When compared to Alternative 4, the use of dredged material would shorten the period needed for these habitats to become fully functional and hence would enable the project to begin providing benefits for wildlife sooner. Similar to Alternative 4, the total acreage of habitat created under Alternative 5 would be greater when compared to Alternatives 2 and 3.

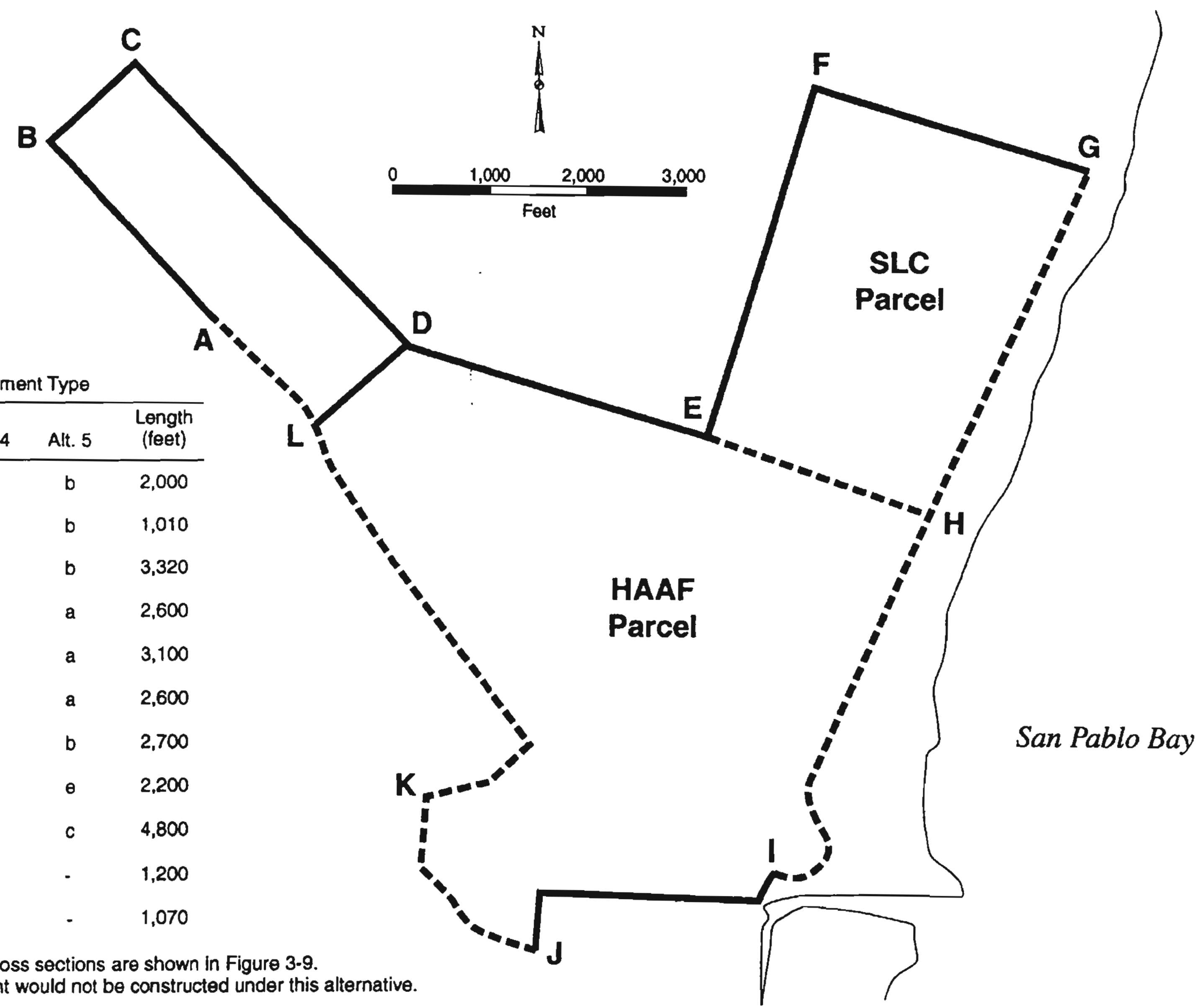
Construction and Restoration Timing

Complete restoration of wetlands under Alternative 5 is estimated to take 30 years. Site construction is estimated to take 6 years to complete and would end with the breaching of the bayward levee. This period would include the following activities:

- 2 years for site preparation,
- 1 year to place 2.1 million cubic yards of dredged material for restoration of seasonal wetlands, and
- 3 years to place 8.5 million cubic yards of dredged material for restoration of tidal wetlands.

The proposed restoration of wetlands in the area is characterized by the following steps, including the estimated time necessary for the restored wetlands to become fully functional:

- sediment accretion to mean high water level (year 7 through year 21),
- development of mean high water marsh plain (year 12 through year 21), and
- development of mean higher high water marsh plain (year 17 through year 31).



Levee Segment	Segment Type: Alt. 4	Segment Type: Alt. 5	Length (feet)
A-B	-	b	2,000
B-C	-	b	1,010
C-D	-	b	3,320
D-E	a	a	2,600
E-F	a	a	3,100
F-G	a	a	2,600
I-J	b	b	2,700
E-H	e	e	2,200
K-L	c	c	4,800
L-A	-	-	1,200
L-D	b	-	1,070

Notes: Levee segment cross sections are shown in Figure 3-9.
- = Levee segment would not be constructed under this alternative.

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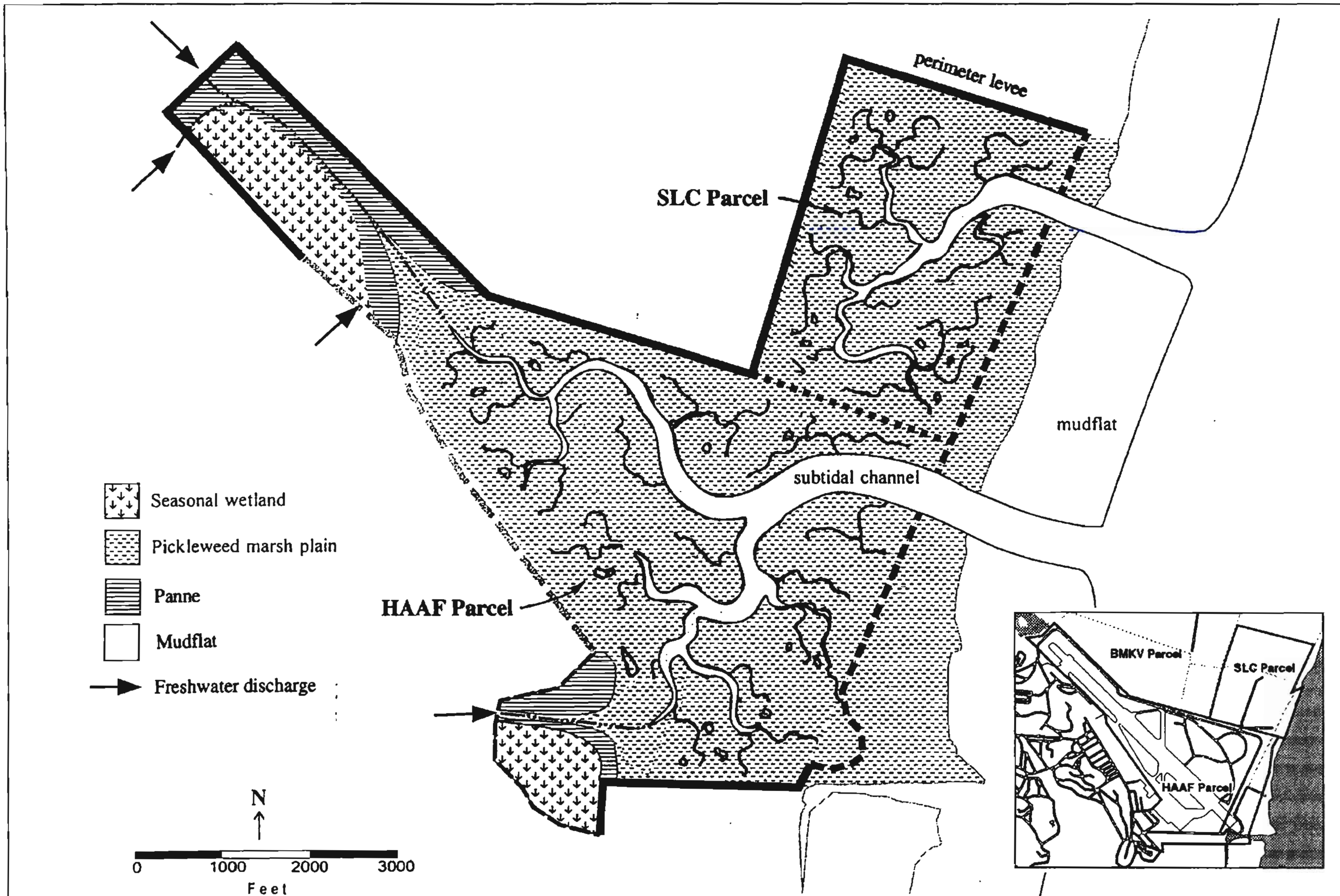
Figure 3-13
Levee Segments for Alternatives 4 and 5



Source: Woodward-Clyde 1998.

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Figure 3-14
Alternative 5: Restoration of Wetlands in the HAAF and SLC Parcels Using Dredged Material at Maturity

An important advantage in the use of dredged material is the substantial decrease in the time necessary for restored wetlands to become fully functional. For example, the mean high water marsh plain is expected to be completely developed 6 years sooner under Alternative 5 than under Alternative 4, and the mean higher high water marsh plain is expected to develop 10 years sooner.

Site Preparation and Placement of Dredged Material

Site preparation activities under Alternative 5 include removing remaining buildings and structures; providing temporary drainage; relocating the NSD dechlorination plant; modifying the NSD outfall pipeline; installing and operating the hydraulic off-loaders and piping to transport dredged materials to the HAAF and SLC parcels; constructing perimeter levees, berms, and internal peninsulas; lowering the bayward levee; and breaching the bayward levee.

Removing Buildings and Structures

The Army ~~may remove some of the remaining buildings and structures~~ has removed building 86 on the HAAF parcel ~~if necessary to complete the remediation of contaminated areas~~. The remaining buildings and structures ~~that may be removed by the Army have not yet been identified. The buildings and structures not removed by the Army would~~ will be removed by the Coastal Conservancy before the bayward levee is breached.

Providing Temporary Drainage

To provide temporary drainage for rainfall and process water from the HAAF and SLC parcels, drainage weirs would be installed through the outboard levee (Figure 3-7). These weirs would be removed when the bayward levee is lowered.

Relocating and Modifying NSD Facilities

Before the levees are constructed between the HAAF parcel and the BMKV and SLC parcels, the NSD dechlorination plant would be relocated and the outfall pipeline would be modified.

The NSD dechlorination plant would be relocated to NSD's Ignacio Treatment Plant, Novato Treatment Plant, or another suitable location. Relocating the dechlorination plant would avoid the need to provide an alternative power supply to the plant and would make the plant more easily accessible to NSD personnel for ~~operational~~ operation and maintenance ~~purposes~~.

The portion of the outfall pipeline that crosses the SLC parcel would be modified to avoid damage that could be caused by placing fill over the pipeline during construction of the perimeter levee between the SLC and BMKV parcels and the levee between the HAAF and SLC parcels. Depths of new fill placed over the pipeline would be 17 feet where the pipeline crosses under the new levee between the SLC and

BMKV parcels and 8-10 feet where the pipeline runs parallel to the new levee between the SLC and HAAF parcels. Damage to the pipeline would be avoided by using site-specific soil treatments to avoid settling and sliplining or by constructing the pipeline with flexible couplings.

Installing and Operating Hydraulic Off-Loaders and Piping

~~To allow the use of dredged material under Alternative 3, a hydraulic off-loader would be placed in San Pablo Bay and piping would be installed to connect the off-loader to the HAAF parcel. The off-loader would be located as much as 34,000 feet offshore but away from major shipping routes (Figure 3-11). The off-loader would be powered by electricity and could be in operation as long as 6 years. Although the exact timing of delivery of dredged material to the off-loader is not known, off-loading could occur at any time during the construction period.~~

~~The off-loader and piping would be properly marked and lighted, consistent with U.S. Coast Guard regulations, to prevent navigational hazards to watercraft using the area at all times of the day and night. The U.S. Coast Guard would be notified to include an update on project activities in its Information Notice to Mariners.~~

To allow the use of dredged material under Alternative 5, two hydraulic off-loaders would be placed in San Pablo Bay, and piping would be installed to connect the off-loaders to the HAAF parcel. One off-loader would be placed in a deep water location and one in a shallow water location. Both off-loaders would be located in western San Pablo Bay but away from major shipping routes (Figure 3-11). The deep water off-loader would be located from 24,000 to 34,000 feet from the project site. The shallow water off-loader site would be located from 15,000 to 25,000 feet from the project site. The off-loaders would be powered by electricity and could be in operation for as long as 4 years. Electricity would be provided by a submerged 12.5-kilovolt power cable via either Point San Pablo or San Rafael Rock Quarry. The cable would be laid and marked in a manner to prevent any land, shore, or navigation hazards. This type of power supply is standard in the dredging industry. Although the exact timing of delivery of dredged material to the off-loaders is unknown, off-loading could occur at any time during the construction period.

The off-loaders and piping would be properly marked and lighted, consistent with U.S. Coast Guard regulations, to prevent navigational hazards to watercraft using the area at all times of the day and night. The U.S. Coast Guard would be notified to include an update on project activities in its Information Notice to Mariners.

Constructing Levees and Internal Peninsulas

Under Alternative 5, ~~17,330~~ 20,400 feet of perimeter levee would be constructed (Figure 3-13). Perimeter levees would separate the HAAF parcel from Landfill 26, the BMKV parcel, and the St. Vincent's and Las Gallinas Sanitary District properties. An additional 2,200 feet of levee would be constructed to protect and allow access to the NSD wastewater pipeline. The levee between the New Hamilton Partnership development and the HAAF parcel provides adequate flood protection to the development and would not be modified for flood control purposes. However, fill would be placed on ~~6,000~~ 4,800 feet on the wetland side of the New Hamilton Partnership levee to create a wildlife corridor (Figure 3-13). To achieve a long-term levee crest elevation of +8 feet NGVD, perimeter levees would be constructed to an elevation of +12 feet initially, to accommodate an estimated 4 feet of long-term settlement.

Before levee construction, a project levee and fill placement plan would be prepared. The plan would address levee and fill placement with respect to site settlement, stability of slopes, soil constraints, and potential for earthquake-induced ground failure. In addition, a ~~monitoring and inspection program~~ maintenance, monitoring, and adaptive management plan would be implemented to evaluate settlement and its effects (Appendix C).

Levee construction techniques would provide adequate stability with regard to the potential for earthquake-induced ground failure. End-of-construction conditions necessary to satisfy the stability factor of safety would be met by constructing levees with side slopes of 3:1 (horizontal to vertical) or flatter and by constructing toe berms on both sides of the perimeter levees averaging 6 feet high and 50 feet wide. The perimeter levees would have a ~~200-foot-wide~~ footprint 200 feet wide. Over time, as the levee settles and the underlying bay mud consolidates and gains strength, the stability ~~factor of safety~~ would increase to a level well in excess of ~~the~~ required stability criteria.

Internal peninsulas would be constructed within the HAAF parcel only. The primary objective of the peninsulas is to reduce fetch and the potential for erosion of perimeter levees from wave action. The cross-sectional dimensions of the internal peninsulas are shown in Figure 3-9.

Internal peninsulas would not be constructed on the SLC parcel. As an alternative to constructing the internal peninsulas, additional material would be added to the SLC parcel perimeter levees. By design, the additional material would erode and protect the integrity of the levee. Use of the two erosion control methods would allow a comparative assessment of the costs and benefits of each method.

Construction of the levees and internal peninsulas could be completed within 6-8 months. A sufficient amount of suitable material is likely to be available from the HAAF and SLC parcels for use in constructing levees and internal peninsulas; however, some material may be brought in from offsite. A specific source for this material has not been identified.

The perimeter levees for the Hamilton wetland restoration project will be designed and constructed by the Corps. Generally, the engineering and design of the levees will be in accordance with the Corps levee engineering and design manual (U.S. Army Corps of Engineers 1978). The levees will be designed for seismic stability in accordance with the levee engineering and design manual and other applicable guidelines (Hynes-Griffin and Franklin 1984, California Department of Mines and Geology 1977). The levees will be designed to withstand earthquake ground motions that have an exceedance probability of 10% in 50 years (primarily the mean peak horizontal acceleration).

Lowering the Bayward Levees

Before it is breached, most of the bayward levee on the HAAF and SLC parcels would be lowered to an elevation similar to the elevation of the marsh plain adjacent to the levee. Portions of the levees would remain at higher elevations to provide high tide refugia. Material removed from the levees would be used for construction of the perimeter levees. A total of 3,900 feet of levee on the HAAF parcel and 3,350 feet of levee on the SLC parcel would be modified.

Breaching the Bayward Levees

After site preparation activities are completed, the levees separating the HAAF and SLC parcels from San Pablo Bay would be breached and pilot channels excavated (Figure 3-13). The levee breach on the HAAF parcel would be 280 feet wide and 200 feet long and the pilot channel would be 165 feet wide and 800 feet long. The levee breach on the SLC parcel would be 220 feet wide and 50 feet long and the pilot channel would be 100 feet wide and 200 feet long.

The combined amount of material removed to breach the levees and excavate the pilot channels would be 61,800 cubic yards. Excavated material would be deposited on the HAAF and SLC parcels.

The surface area disturbed by the levee breaches and pilot channels would total 5.4 acres. Excavating the levee breaches and pilot channels would affect 1.8 acres of grassland and 3.6 acres of coastal salt marsh.

Track-mounted excavators would be used to excavate the levee breaches. A 6- to 10-inch suction dredge mounted on a small barge would be used to excavate the pilot channels. Material excavated by the dredge would be pumping directly to the HAAF and SLC parcels. This method would limit the amount of coastal salt marsh disturbed during the dredging process. Regardless of the availability of sediments, levee breaches would be completed no later than 8 years after site preparation begins.

Source of Dredged Material

Dredged material for the wetland restoration project could originate from many sources. One of the most likely sources is the Oakland Harbor navigation improvement project. Other potential sources of material are the Concord Naval Weapons Station, Southhampton Shoal, Richmond Harbor, Port Sonoma, Bel Marin Keys, and Bahia Lagoon. Evaluating impacts associated with dredging and transporting material to the off-loaders is assumed to be the responsibility of the sponsor of each project. An EIR/EIS was recently completed on the Oakland Harbor navigation improvement project (U.S. Army Corps of Engineers and Port of Oakland 1998a, 1998b, 1998c, and 1998d). That document addressed impacts associated with transporting dredged material to the HAAF parcel and concluded that transporting material on barges would not result in significant impacts on the environment.

Suitability of Dredged Material

The suitability of dredged material for the project site will be determined through the existing testing and suitability framework used by the state and federal agencies charged with approving disposal of material dredged from San Francisco Bay: the RWQCB, BCDC, EPA, and the Corps.

These agencies have established a cooperative DMMO, which makes joint recommendations on the suitability of dredged material for proposed disposal sites. The agencies require dredging project applicants to sample and test sediments proposed to be dredged for chemical constituents of concern and for toxicity, using protocols acceptable to the agencies. The adequacy of the sampling and testing is evaluated by the DMMO, which then reviews the test results to evaluate the acceptability of the dredged material for disposal at proposed sites in the bay, ocean, wetland, or upland environments.

To aid in determining the suitability of dredged material for use in wetland environments, the RWQCB has developed guidelines, known as the Wolfenden and Carlin guidelines (Wolfenden and Carlin 1992), that identify acceptable contaminant levels for use in wetlands projects. The DMMO will use these or updated guidelines and other pertinent information to assess any dredged material proposed for use at the project site. Although the Wolfenden and Carlin document specifies slightly differing guidelines for "cover" material (which can be used anywhere in a wetland) and "noncover" material (which needs to be properly buried), only material appropriate for "cover" as determined by the DMMO will be accepted for use at the project site. Separate tests for contaminant leaching are used to evaluate the acceptability of material for upland disposal. Only material found suitable by the DMMO will be used as part of the upland components of the project.

Placement of Dredged Material

The time elapsed between the initiation of site preparation activities to place dredged material and breaching of the levees on the HAAF and SLC parcels is expected to be 6 years and could extend to a maximum of 8 years. Placement of dredged material could be divided by location, including nontidal areas, the SLC parcel, and the remaining portion of the HAAF parcel, with sediment placement occurring either sequentially or concurrently. The specific sediment timing and locations of levee breaches would depend on the availability of dredged material and the feasibility of constructing the three areas in separate phases. However, the wetland restoration project could begin to accept dredged material during the site preparation phase.

Routine maintenance dredging could provide, on average, as much as 2.2 million cubic yards of dredged sediment per year. However, the schedule for placement of material assumes that 1.4 million cubic yards of sediment per year are actually dredged. The actual annual dredging volumes are dependent on many factors. For example, dredged sediment may be available from new channel and harbor deepening projects, which would shorten the overall construction schedule. Placement of dredged material in the seasonal wetland will be engineered to ensure impermeability of the surface for seasonal ponding and to minimize cracking during the dry season.

Control of Process Water

The off-loading of dredged material would involve mixing the material with water to allow pumping. After the dredged material slurry is placed, the water would separate from the material and would eventually be discharged to San Pablo Bay. Certain options been proposed that would ensure that the process water does not violate water quality standards when discharged to the bay. The most viable option is to hold the water in a confined basin within the restoration site for subsequent discharge.

Water quality standards will be specified in the waste discharge requirement stipulated by the RWQCB. The discharge standards for the process water will meet RWQCB standards before water is discharged to the bay.

Public Access

Public access to the wetland restoration site would be provided by ~~the proposed Bay Trail and spur trails. In addition to the Bay Trail proposals, HRG is proposing an alignment that would provide enhanced public access to the western side of the wetland restoration project, generally along the New Hamilton Partnership levee.~~ trails on the western side of the wetland restoration site, generally along the New Hamilton Partnership levee. In addition, the City of Novato will provide a scenic overlook at the top of Reservoir Hill. ~~Formal~~ Public access to the wetland restoration site would be limited to these points, generally located on the western edge of the site. To protect resource values, public access would not be allowed to the entire site.

Bel Marin Keys V Restoration Scenario: Restoration of Wetlands in the HAAF, SLC, and BMKV Parcels Using Dredged Material

In addition to the four project alternatives, a wetland restoration scenario that includes the BMKV parcel, located northeast of the HAAF parcel, has also been evaluated. Impacts of expanding the wetland restoration project to include the BMKV parcel have been evaluated at the program level and are included for informational purposes. Expanding the wetland restoration project to include the BMKV parcel would substantially increase the amount of wetlands that would be restored, increase the amount of area that could be used for disposal of dredged material, and reduce the number of levees that would need to be constructed. Including the BMKV parcel as part of the wetland restoration project would require separate project-specific documentation under CEQA and/or NEPA.

The BMKV parcel is located north of the HAAF and SLC parcels and is privately owned (Figure 3-2). The owners are proposing a water-oriented residential community and golf course on an approximately 1,610-acre site. The residential component would consist of 801 units on 146 acres. The proposed project is currently being reviewed by the County of Marin. Because development plans for the parcel have not been approved, this analysis assumes that the use of the parcel for production of hay would continue under future without-project conditions.

Under the BMKV Scenario, wetlands would be restored in the HAAF, SLC, and BMKV parcels through the use of dredged material and natural sedimentation. Before dredged material is placed in the area, perimeter levees would ~~not~~ be constructed as needed and the bayward levee would be breached. The three parcels would not be hydrologically connected because of the need to protect the NSD outfall pipeline.

Restoration Targets

The ultimate objective of a fully functioning wetland restoration project under the BMKV scenario is to create tidal coastal salt marsh, seasonal wetlands, tidal pannes, and grasslands. An estimate of the acreage of each habitat type that would be created or enhanced under this scenario is shown in Table 3-2. This estimate is based on habitat ratios developed for Alternative 5. The predominant habitat types would be tidal coastal salt marsh and seasonal wetland.

Table 3-2.
Estimated Acreage of Each Habitat Type for the Bel Marin Keys V Scenario

Habitat Type	Acres
Subtidal channels	13
Coastal salt marsh (tidal)	1,696
Tidal pannes	80
Seasonal wetland	314
Grassland	204

Construction and Restoration Timing

Complete restoration of wetlands under this scenario would involve a process similar to that proposed for Alternative 5 (30 years) but would probably take longer because of the substantial increase in the number of acres to be restored and the increased volume of dredged material that would be deposited on the project site. The estimated dredged material capacity of the combined BMKV, HAAF, and SLC parcels would total 33 million cubic yards of material.

Site Preparation

Site preparation activities under this scenario would include constructing the perimeter levees, lowering the bayward levee, rnoving the NSD dechlorination plant, and installing and operating the hydraulic off-loaders. The process for installing and operating the hydraulic off-loaders would be the same as described under Alternative 3.

Constructing Perimeter and Internal Levees

Under this scenario, 23,800 feet of perimeter levee would be constructed. These levees would separate the project site from Landfill 26, Pacheco Pond, the existing Bel Marin Keys development, and the St. Vincent's and Las Gallinas Sanitary District properties. The levee separating the HAAF parcel from the BMKV and SLC parcels would remain to protect and provide access to the NSD outfall pipeline.

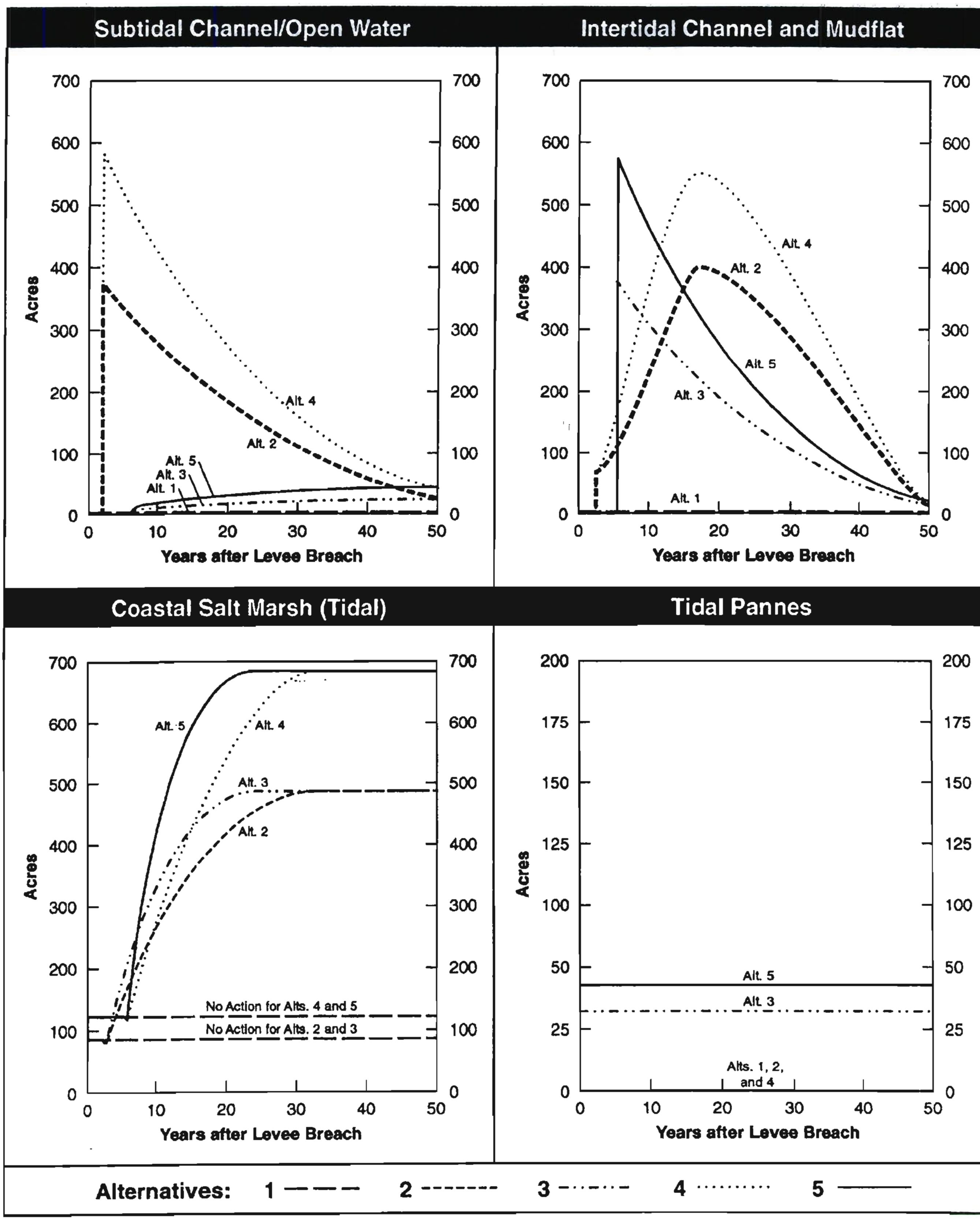
Construction of the levees could be completed within 6-8 months. An adequate volume of source material to construct these levees is probably available from the three parcels.

Lowering the Bayward Levee

Before it is breached, most of the bayward levee on the HAAF, SLC, and BMKV parcels would be lowered to an elevation similar to the elevation of the marsh plain adjacent to the levee. Portions of the levees would remain at higher elevations to provide high tide refugia. Material removed from the levees would be used for construction of the perimeter levees.

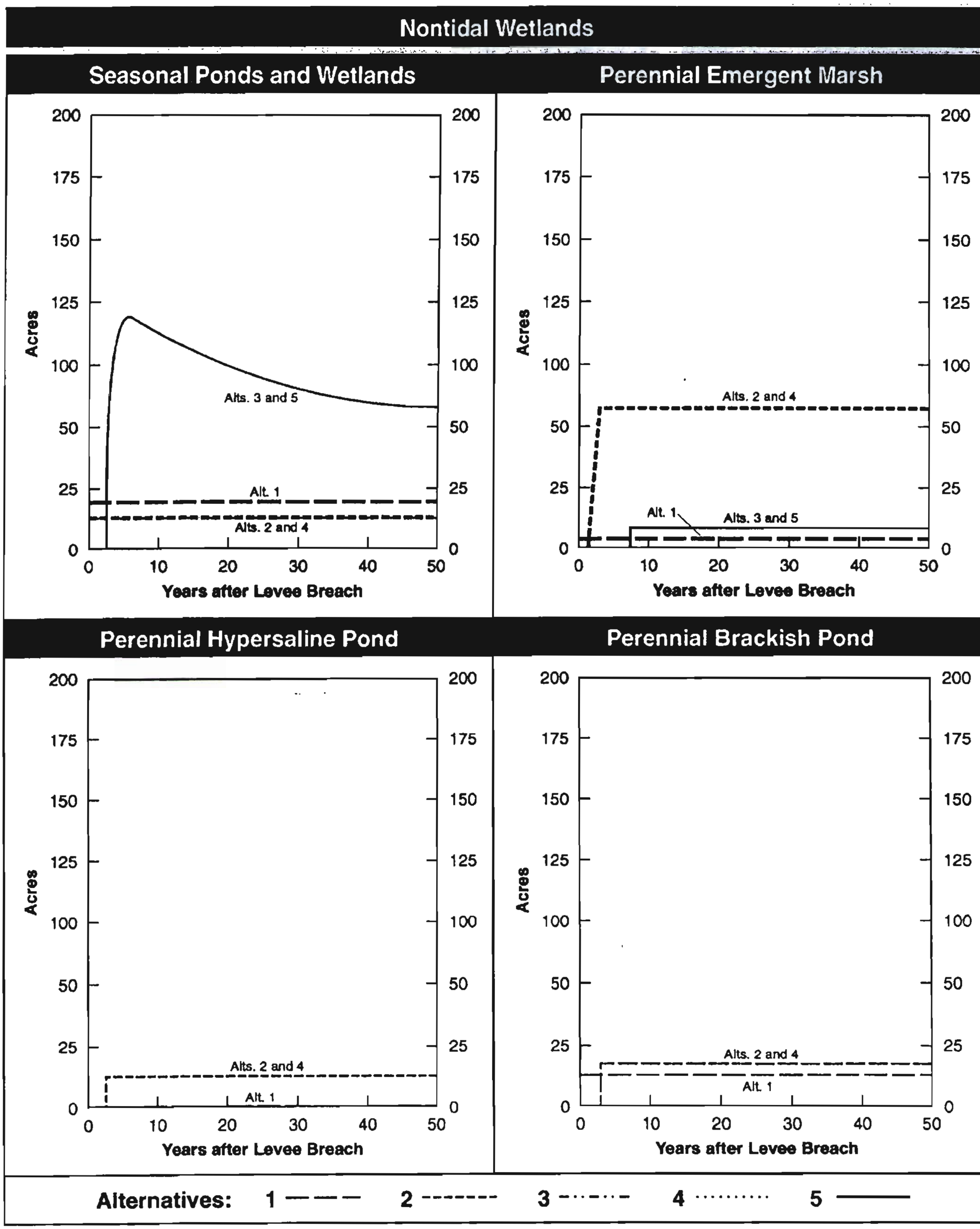
Breaching the Bayward Levee

After construction of the perimeter levees and placement of dredged material are completed, the levee separating the HAAF, SLC, and BMKV parcels from San Pablo Bay would be breached. Two or more channels of the same or similar configuration as described under Alternative 5 would be constructed. Material from the excavation would be deposited within the HAAF, SLC, and BMKV parcels. The direct loss of pickleweed marsh would be limited to the width and length of the channel.



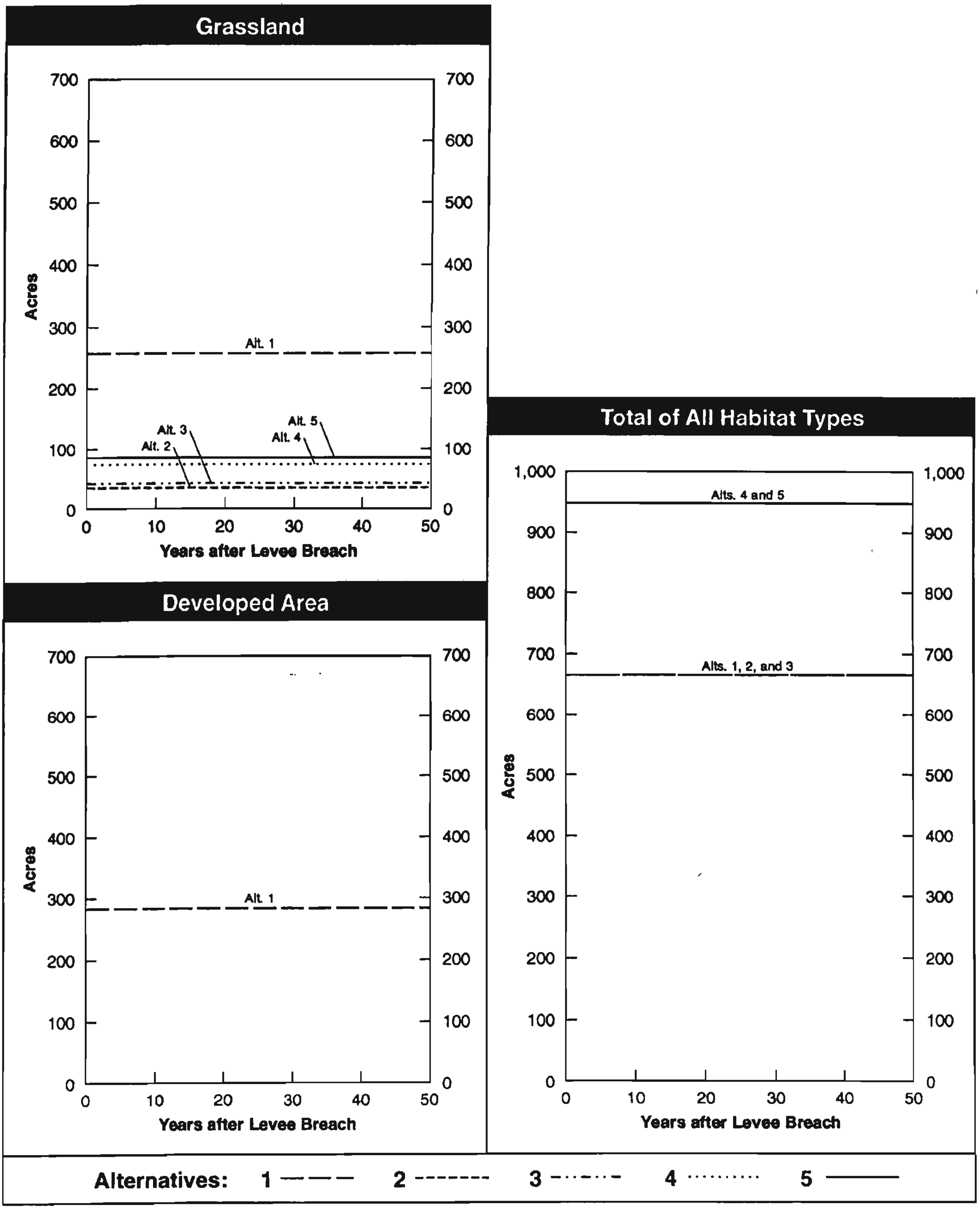
Jones & Stokes Associates, Inc.

Figure 3-5a
Habitat Acreages at Levee Breach and 50 Years after Levee Breach



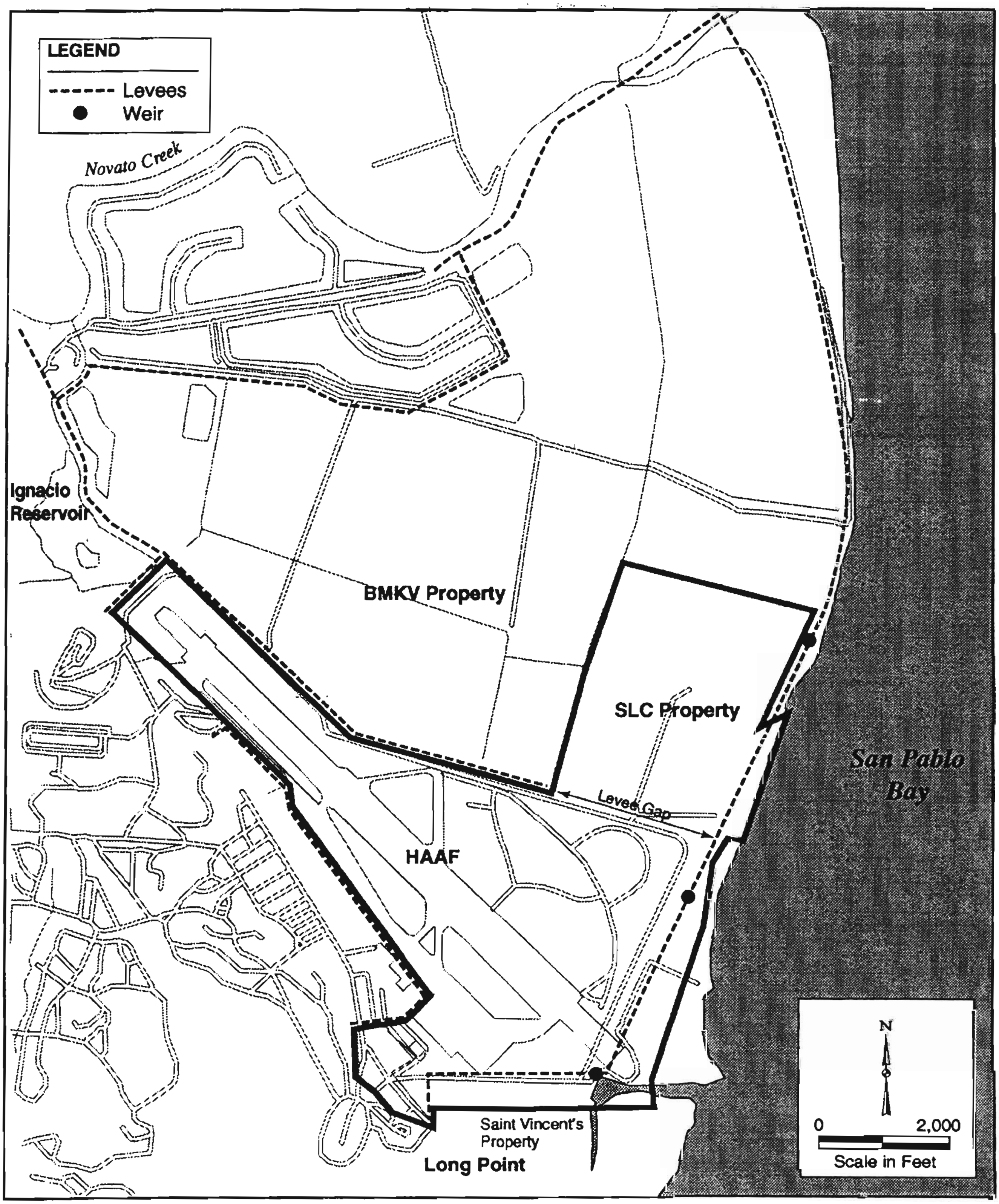
Jones & Stokes Associates, Inc.

Figure 3-5b
Habitat Acreages at Levee Breach and 50 Years after Levee Breach



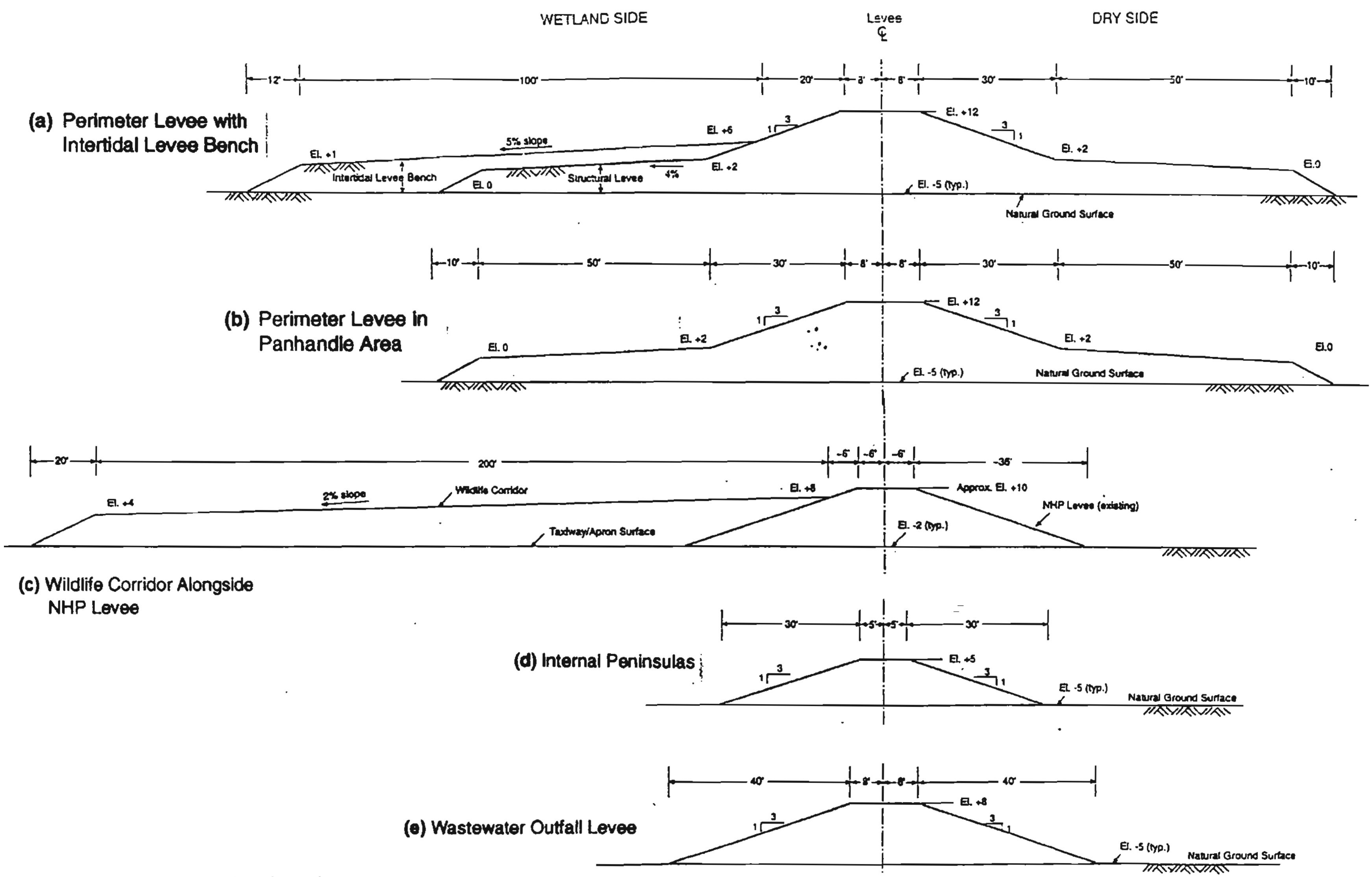
Jones & Stokes Associates, Inc.

Figure 3-5c
Habitat Acreages at Levee Breach and 50 Years after Levee Breach



Jones & Stokes Associates, Inc.

Figure 3-7
Temporary Drainage Weirs

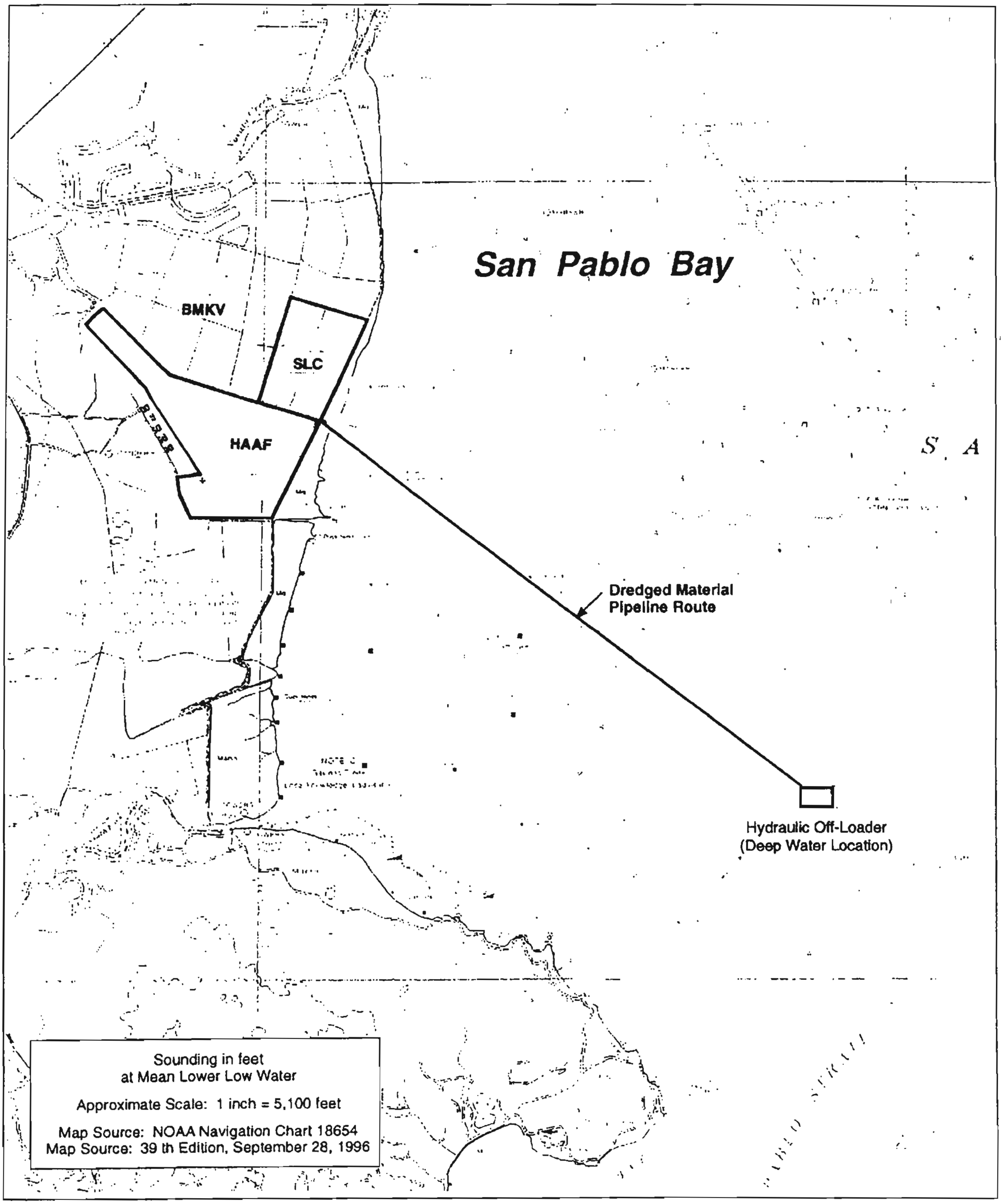


Note: End-of-construction elevations shown; final evevations will be lower.

Source: Woodward - Clyde 1998.

Jones & Stokes Associates, Inc.

Figure 3-9
Typical Levee Cross Sections



Source: Woodward-Clyde 1998.

Jones & Stokes Associates, Inc.

Figure 3-11
Location of Hydraulic Off-Loader and Pipeline Routes

Appendix B

Bel Marin Keys Hydrologic and Hydraulic Modeling and Supporting Information

Memorandum

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west sacramento, ca 95691
(916) 371-7400
(916) 371-7475 (fax)

Date:	14 October 2002	**Project:**	50283
To:	Rich Walter		
Company/Agency:	Jones & Stokes		
From:	Brad Hall		
Subject:	Hydrologic and Hydraulic Modeling Assessment of Existing and Project Alternatives at Bel Marin Keys V		

This memorandum is issued to clarify citations presented in the 18 April 2002 memorandum. The analyses, results, and conclusions of this memorandum were not modified from the 18 April 2002 memorandum.

Overview

This document presents Northwest Hydraulic Consultants (**nhc**) investigation of the hydraulic impact of the proposed Bel Marin Keys tidal marsh restoration project. This study quantitatively assesses the relative change of the proposed project on Pacheco Pond stages and Novato Creek stages from the Pacheco Pond outlet to the creek mouth.

The proposed tidal marsh restoration at Bel Marin Keys will affect the hydrology of several elements within the lower Novato Creek basin. Proposed modifications to Pacheco Pond and the proposed diversion of flow away from Novato Creek considered in the design alternatives will present the most substantial effects. The proposed modifications to Pacheco Pond consist of either expanding the existing pond, or creating a seasonal marsh adjacent to the pond. In addition, the diversion of water currently flowing into Novato Creek from Pacheco Pond, to the proposed tidal marsh will greatly affect existing conditions on the Bel Marin Keys tidal wetlands restoration site. These flows will provide fresh water for the proposed freshwater marsh portion of the project.

To assess the impacts of the proposed tidal wetland restoration on the hydrology of the existing site a review of hydrologic studies of the Novato Creek and Pacheco Pond watersheds was completed. Existing and proposed site conditions that affect the drainage and flooding characteristics were identified. Representative flood hydrographs and tidal stage characteristics were determined and used for computing flood stage and discharge conditions in the study area. To quantify the changes in flood stage and discharge magnitude resulting from coincident terrestrial and tidal flood conditions, a one-dimensional, unsteady flow model of the Novato Creek and Pacheco Pond system was developed. Described below are some features of this modeling effort, including a description of the basin, the proposed alternatives, the model itself, and the model results.

Basin Description

The components of the Pacheco Pond watershed consist of two small streams, Pacheco Creek and Arroyo San Jose, which drain into a constructed detention reservoir, Pacheco Pond. Pacheco Pond currently discharges into Novato Creek and finally, San Pablo Bay (Figure 1). Historically, Pacheco Creek and Arroyo San Jose discharged into the tidal marsh to the south of the Bel Marin Keys development. The specific features of the watershed are described below.

- *Pacheco Creek*

Pacheco creek drains a 1.9 square mile watershed. From the headwaters 3 miles to the west, the stream crosses several roads, including Highway 101, through a series of culverts. Flooding is known to occur in the lower reaches of Pacheco Creek, prior to entering Pacheco Pond, for flood events with magnitudes less than the 10-year event (1).

However, because this study focused on the area downstream of Pacheco Pond, the flooding of the creek upstream of the pond was not analyzed in the modeling study. Flows of Pacheco Creek into the pond were modeled as an inflow hydrograph entering the pond, as will be described below. Additional survey of channel cross sections and physical characteristics of the local storm drainage system would be required to quantify flooding conditions upstream of Pacheco Pond and within the Ignacio Business Park.

- *Arroyo San Jose*

The Arroyo San Jose watershed drains an area of approximately 5.4 square miles. Arroyo San Jose accounts for approximately three-quarters of the inflow to Pacheco Pond (2). Previous hydrologic studies of the basin indicate that the Arroyo San Jose remains within its banks for flood events up to the 100-year flood. However, accompanied with high tides in Novato Creek and the associated constriction of flow release from Pacheco Pond, the 100-year event can cause minor flooding of residential and business areas near the confluence with Pacheco Pond (1).

- *Pacheco Pond*

Pacheco Pond covers an area of approximately 120 acres. The estimated flood storage volume between elevations 0.0 and 7.0-ft, NGVD 29, is approximately 866 acre-ft. The storage volume of the reservoir was estimated from existing topographic surveys, aerial photos, and previous engineering studies (3, 4). A stage-volume relation for Pacheco Pond was determined and utilized to compute the pond storage and resultant water surface elevation during storm events.

Pacheco Pond discharges into Novato Creek via a leveed channel controlled by six 4-ft by 4-ft flap gated culverts. The invert elevation of the culvert structure was independently surveyed by **nhc** and the Marin County Flood Control District to have an invert elevation of –0.86-ft, NGVD 29. It appears that the invert of the culvert was not accurately surveyed in earlier studies of Pacheco Pond hydrology, and was reported to have an invert elevation of –1.8-ft, NGVD 29 (2). The effect of the flap gate was modeled by only allowing flow in the positive direction (toward Novato Creek) through

the box culvert. Minor leakage and backflow through the flap gates was not modeled in this analysis.

During high flow events the water level in Pacheco Pond can exceed adjacent levee elevations. The lowest point exists north of the pond, adjacent to the Leveroni property, where the measured low point of the levee is 5.6-ft, NGVD 29 (2). These low points were considered in the model by including lateral weirs to direct flow to adjacent storage areas when stages in the pond exceeded 5.6-ft. Top of levee surveys also indicate that a significant extent of this levee is at an elevation of approximately 6.7-ft, NGVD 29. Additional lateral overflow weirs were specified at this higher top of levee elevation in the hydraulic model.

- *Novato Creek*

Novato creek is the main drainage course in the region with an approximate total watershed area of 44 square miles (5). However, breakout flows due to flow constrictions at the railroad bridges downstream of Highway 101, and adjacent to Highway 37, reduce the overall peak flood discharge (6). An infinite variation in the timing of peak discharges between Novato Creek and Pacheco Pond hydrographs is possible; however, the Novato Creek peak would be expected to lag the Pacheco Pond peak due to the larger watershed area of Novato Creek. Water surface conditions within Pacheco Pond and within Novato Creek were evaluated for lag times between peak flows of zero, six, and 12 hours.

Cross sections of Novato Creek were developed by **nhc** from existing LiDAR (3) and bathymetric surveys (7). The cross sections depict the subtidal channel of the creek, adjacent tidal marsh surface, and existing levee structures that currently constrain the Novato Creek floodplain. Top of levee surveys completed in 1996, indicate that the levee crest between Novato Creek and the Bel Marin Keys V site dips to an elevation of approximately 5.6-ft, NGVD 29, at a point approximately 1000 feet downstream from the Bel Marin Keys South Lagoon navigation lock. Overtopping of this levee was observed by Bel Marin Keys residents in the February 1998 flood event. The location of this overtopping was incorporated in the hydraulic model by specifying an overtopping weir with a crest elevation of 5.6-ft, in the model geometry at this location.

- *San Pablo BayTides*

Tides in San Pablo Bay follow a mixed semidiurnal cycle, with two high and two low tides, of differing heights, occurring in a single day. Due to geographic and hydrodynamic complexities, mean tide levels vary throughout the San Francisco/San Pablo Bay system. Tide cycles in San Pablo Bay are seen to lag those at the Golden Gate by as much as 75 minutes (2). Peak tide water surface elevations in the vicinity of Novato Creek are reported as 6.0-ft, NGVD 29 for the 10-year tide and 6.5-ft, NGVD 29 for the 100-year tide (8). FEMA maps tidal water surface elevations to the nearest whole-foot (9). Therefore, the Base Flood Elevation resulting from tidal flooding in the City of Novato is 7 feet (10).

Storm events lead to higher tidal stages than those predicted by gravitational forces for a variety of reasons. First, low barometric pressures associated with significant storm frontal passage leads to a regional rise in tidal stage as the oceans surface level increases in response to the reduction in overlying atmospheric pressure. Second, wind

stresses may lead to a storm surge setup, further increasing peak tidal stage. Third, increases in large scale regional runoff from the Sacramento and San Joaquin watersheds, as well as contributions from San Francisco Bay watersheds, limit the low tidal excursion of normal tidal cycles. San Pablo Bay, in essence, is filled with regional runoff (11).

The tide measurements taken at the mouth of the Petaluma River were utilized to develop time series of tidal stage hydrographs at the mouth of Novato Creek. These data, completed as part of the San Francisco Airport runway expansion dredge material disposal studies, consist of tidal stage measurements recorded at 10-minute increments for the duration of approximately one month (14 June - 17 July 2000) (3). Earlier studies of Novato Creek indicate negligible differences between Novato Creek and Petaluma River tidal stage characteristics (2). To conservatively estimate tidal conditions during flood events, these tide stage data were modified in two ways to reflect extreme tidal conditions that occur during significant flooding events. The first modification was to increase the observed peak tidal stage by one foot to reflect extreme high tides due to low atmospheric pressure and wind setup in the region. This is equivalent to coincident tidal stage boundary conditions frequently used by the Corps of Engineers and the FEMA for flood control design or flood hazard mapping studies on tidally influenced streams and rivers (12). The resulting peak tide is 5.75 feet, 0.25 feet lower than the 10-year peak tide of 6 feet. The second modification was to truncate the low tide elevation at the mean tide level to represent limits on low tide excursion due to extreme regional, basin-wide runoff conditions.

Alternative Descriptions

The descriptions of Alternatives 1, 2, and 3, given below consist of that information that is relevant to the hydrologic modeling effort. That is, only the elements that affect the hydrology and hydraulics of the site are considered. For all project alternatives, Pacheco Pond flows will be routed to Novato Creek during storm events. In the following analyses, Pacheco Pond flows were routed to the restored tidal marsh for all project alternatives. The key hydrologic characteristics of the three alternatives are described below:

Alternative 1

- Pacheco Pond expanded to a capacity of approximately 1241 acre-ft (above 0-ft, NGVD 29)
- flow diverted to proposed tidal marsh from Pacheco Pond through a flap gated culvert structure identical to the existing one at Novato Creek

Alternative 2

- seasonal wetland constructed adjacent to existing Pacheco Pond with a storage volume of approximately 1155 acre-ft (above 0-ft, NGVD 29)
- existing Pacheco Pond and seasonal wetland connected with a 100-ft wide weir, with a crest elevation of 2-ft, NVGD 29
- flow from the seasonal wetland is released to the proposed tidal marsh through a flap gated culvert structure identical to the existing one at Novato Creek

Alternative 3

- for the purposes of this analysis, identical to Alternative 1

UNET Model Description

To evaluate the hydraulics of the existing study basin, as well as the proposed project conditions, the hydraulic modeling program UNET was employed. UNET was developed by the U.S. Army Corps of Engineers, and provides a modeling framework for computing solutions to one-dimensional, unsteady flow problems in complex networks. The choice of using such a model was deemed necessary here due to the dynamic conditions caused by both the fluctuating tide levels in San Pablo Bay, and the rapid changes in water surface elevation expected within Pacheco Pond.

The UNET model requires hydraulic boundary conditions for both the upstream and downstream ends of the study site. For this study, the downstream boundary conditions consisted of the modified, tidal time series measured at the mouth of the Petaluma River as described above. The tidal time series data are shown in Figure 2.

The upstream boundary conditions consisted of inflow storm hydrographs. The storm hydrographs for Pacheco Creek at Pacheco Pond, Arroyo San Jose at Pacheco Pond, and Novato Creek near Highway 37 were obtained from previous studies (2, 5, 6). The hydrologic conditions considered in the analysis consisted of two scenarios. These scenarios, referred to here as A and B, are meant to loosely represent the 10-year and 100-year storm events, respectively. However, a detailed assessment of present and future watershed conditions, coincident storm peak flow analysis, and hydrologic routing characteristics that would more accurately define the expected characteristics of storm hydrographs was beyond the scope of this study. The flow hydrographs for Arroyo San Jose, Pacheco Creek, and Novato Creek for both scenarios A and B are shown in Figures 3, 4, and 5.

Theoretically, there are infinite combinations of phasing between the peak tide and the peak discharge hydrographs. To simplify the analysis, Pacheco Creek and Arroyo San Jose hydrographs were phased to be coincident with the higher high water tidal stage for all model runs. However, the phasing of the Novato Creek hydrograph was varied to investigate the effect of lag times on system. Due to the larger watershed dimensions, the peak discharge from Novato Creek would be expected to lag the Pacheco Pond peak discharges. Novato Creek hydrographs specified at three different lag times relative to the peak hydrograph from the Pacheco Pond watershed: 0-hour lag time (i.e. coincident with the higher high water tide stage and other hydrographs), 6-hour lag time (i.e. 6 hours behind other hydrographs), and 12-hour lag time. The adjustment of phasing was only relevant to the model runs that evaluated the existing conditions, as Pacheco Pond flows are routed away from Novato Creek for all project condition scenarios.

The general modeling strategy was to isolate elements within the drainage system in order to assess their relative effect on peak flows and water surface elevations. A key caveat of this analysis is that the primary consideration should be in comparing *relative* differences between computed peak discharges and water surface elevations. Detailed and consistent surveys of the physical characteristics of Pacheco Pond and Novato Creek are necessary to identify accurate, water surface elevations. These surveys were beyond the scope of this conceptual planning effort. However, *relative* differences in peak water surface elevations and flowrates between the alternative conditions assessed in this analysis are fairly insensitive (less than 0.25 feet) to the small changes in absolute geometric conditions (e.g. plus or minus 1-foot of vertical difference in invert

elevations). Thus, the relative changes between existing and project alternative conditions can be used to assess project performance and impacts.

Four cases were considered. The first consisted of modeling the existing Pacheco Pond-Novato Creek system. The second case considered only Novato Creek, without contributing flows from Pacheco Pond, and the third and fourth cases considered only the isolated Pacheco Pond. These third and fourth cases were used to evaluate the effects and differences between Alternatives 1 & 3, and 2, on pond hydraulics. The primary assumption in the third and fourth cases is that the entire flow into Pacheco Pond will be rerouted to the proposed tidal marsh. Table 1 outlines the modeling conditions for each case.

Table 1. UNET Model Conditions

Case	Model Conditions
Existing Novato Creek and Pacheco Pond Network - Evaluates the interaction between Pacheco Pond and Novato Creek for existing conditions	**Boundary Conditions** • Arroyo San Jose: Scenario A and B Hydrographs • Pacheco Creek: Scenario A and B Hydrographs • Novato Creek: Scenario A and B Hydrographs; 0, 6, 12 hour lag • San Pablo Bay: Truncated/amplified tide series **Model Elements** • Six 4-ft tall by 4-ft wide, unidirectional box culvert controls flow to Novato Ck • 100-ft wide lateral weir at 5.6-ft, NGVD 29 for pond overflow to Leveroni Property • 1000-ft wide lateral weir at 6.7-ft, NGVD 29 for pond overflow • 300-ft wide lateral weir at 5.6-ft, NGVD 29 for Novato Ck overflow to BMKV wetlands restoration site downstream of BMK residential development.
Project Conditions on Novato Creek- Evaluates only Novato Creek while considering influence of added restored tidal prism downstream of BMK residential development. The connection with Pacheco Pond is removed from the model.	**Boundary Conditions** • Novato Creek: Scenario A and B Hydrographs; 12 hour lag • San Pablo Bay: Truncated/amplified tide series **Model Elements** • right bank levee removed downstream of BMK residential development • right bank floodplain expanded laterally by 1000-ft downstream of BMK residential development to reflect opportunity for overflow into restored tidal marsh • 450-acre tidal marsh modeled as storage area with hydraulic connection through new breach channel to lower Novato Creek.
Pacheco Pond Configuration for Alternative 1 & 3 - Evaluates an expanded Pacheco Pond with a flap gate outlet to the tidal marsh	**Boundary Conditions** • Arroyo San Jose: Scenario A and B Hydrographs • Pacheco Creek: Scenario A and B Hydrographs • San Pablo Bay: Truncated/amplified tide series **Model Elements** • Pacheco Pond expanded • Six 4-ft tall by 4-ft wide, unidirectional box culvert controls flow to tidal marsh
Pacheco Pond Configuration for Alternative 2 - Evaluates Pacheco Pond with an adjacent seasonal marsh storage area, flow controlled by weir and flap gate structure	**Boundary Conditions** • Arroyo San Jose: Scenario A and B Hydrographs • Pacheco Creek: Scenario A and B Hydrographs • San Pablo Bay: Truncated/amplified tide series **Model Elements** • Additional 650-acre storage area attached to Pacheco Pond to simulate constructed seasonal wetland • 100-ft wide inline weir to control flow from pond to seasonal marsh • Six 4-ft tall by 4-ft wide, unidirectional box culvert controls flow to tidal marsh

Model Results

The UNET model results of primary interest are the effects of the proposed tidal restoration on the stage within Pacheco Pond and Novato Creek. With respect to the former, comparison between the stage hydrographs within the existing pond (Figs. 6 and 7) and those of Alternatives 1 & 3, and 2 (Figs. 8 and 9), show that the proposed changes will substantially reduce peak water surface elevations within Pacheco Pond (Table 2). This reduction in Pacheco Pond elevations will have a positive benefit on Ignacio Business Park drainage conditions that are presently aggravated by high stages within Pacheco Pond. The magnitude and extent of this improvement to local storm drainage conditions, however, was not quantified in this analysis.

Table 2. Peak Water Surface Elevations in Pacheco Pond (ft, NGVD 29)

Case	Scenario A	Scenario B
Existing	6.4	7.6
Alternative 1 & 3	4.5	7.2
Alternative 2	4.6	6.3

Also of interest are the effects of the proposed project on stages within Novato Creek. Under the project alternatives being considered for the Bel Marin Keys tidal wetland restoration, all flow from Pacheco Pond will be diverted away from Novato Creek and routed through new drainage structures into the proposed tidal marsh. To examine the effect of this diversion, stage hydrographs at select locations along Novato Creek are presented in Figures 10 and 11, for scenarios A and B, respectively. The locations chosen include the upstream limit of the model at Highway 37 bridge (CS 10), at the existing confluence of Pacheco Pond with Novato Creek (CS 8), and just downstream of the lower Bel Marin Keys navigational lock (CS 4).

The stage hydrographs shown in Figures 10 and 11, suggest that peak water surface elevations within Novato Creek are controlled primarily by tidal fluctuations. That is, the effects of diverting Pacheco Pond flow, in addition to the added tidal prism created by the constructed tidal marsh, do not substantially change the peak water surface elevations between existing and project conditions. The changes that do occur are a negligible drop (less than 0.1 foot) in peak stage when Pacheco Pond flow is diverted.

References:

1. Jones & Stokes Associates Inc., 1998 (December), "Hamilton Army Airfield Wetland Restoration, Final EIR/EIS" California State Coastal Conservancy, and U.S.A.C.E, S.F.

2. Philip Williams & Associates Ltd., 1998 (October), "Appendix E: Hamilton Base Realignment & Closure, Wetland Conversion Alternative: Airfield Panhandle Flood Assessment", Prepared for IT Corp.

3. San Francisco International Airport's Airfield Development Engineering Consultant (ADEC). 2000. (1) Text file, EXCEL spreadsheet with bathymetry and tide data; (2) digital orthometric photography; (3) LiDAR topography, vertical

datum NGVD 1929, horizontal datum NAD 1983. Provided by Moffit Nichol Engineers.

4. Gonzalez and Oberkamper Civil Engineers, Inc., 1975. “Appendix IV Drainage Analysis Ignacio Industrial Park Marin County, California”. Prepared for Madrone Associates Environmental Consultants. “Final Environmental Impact Report Ignacio Industrial Park, Unit 3”.

5. U.S. Army Corps of Engineers, San Francisco District, 1987, "Hydrologic Engineering Report, Novato Creek and Adjacent Streams", City of Novato, Marin County, California.

6. CSW/Stuber-Stroeh Engineering Group Inc., 1996 (January), "Bel Marin Keys V Master Storm Water Management Plan", Prepared for the Presidio Group.

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9. Federal Emergency Management Agency (FEMA), 2002. “Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix D: Guidance for Coastal Flooding Analyses and Mapping”, www.fema.gov/mit/tsd/dl_cgs.htm.

10. Federal Emergency Management Agency (FEMA), 2002. “City of Novato, California, Flood Insurance Rate Map Community-Panel Number 060178 0005 B”, Map Revision Date April 3, 1984.

11. Charles D. Anderson, Katherine M. Oven, Christy Chung, 2000. “Surf's Up – or Tide Cycles During Storm Events.” Spring 2000 Floodplain Managers Association Conference, San Diego, CA.

12. U.S. Army Corps of Engineers, Sacramento District. 1993. “Coyote and Berryessa Creeks, California Final General Design Memorandum”.

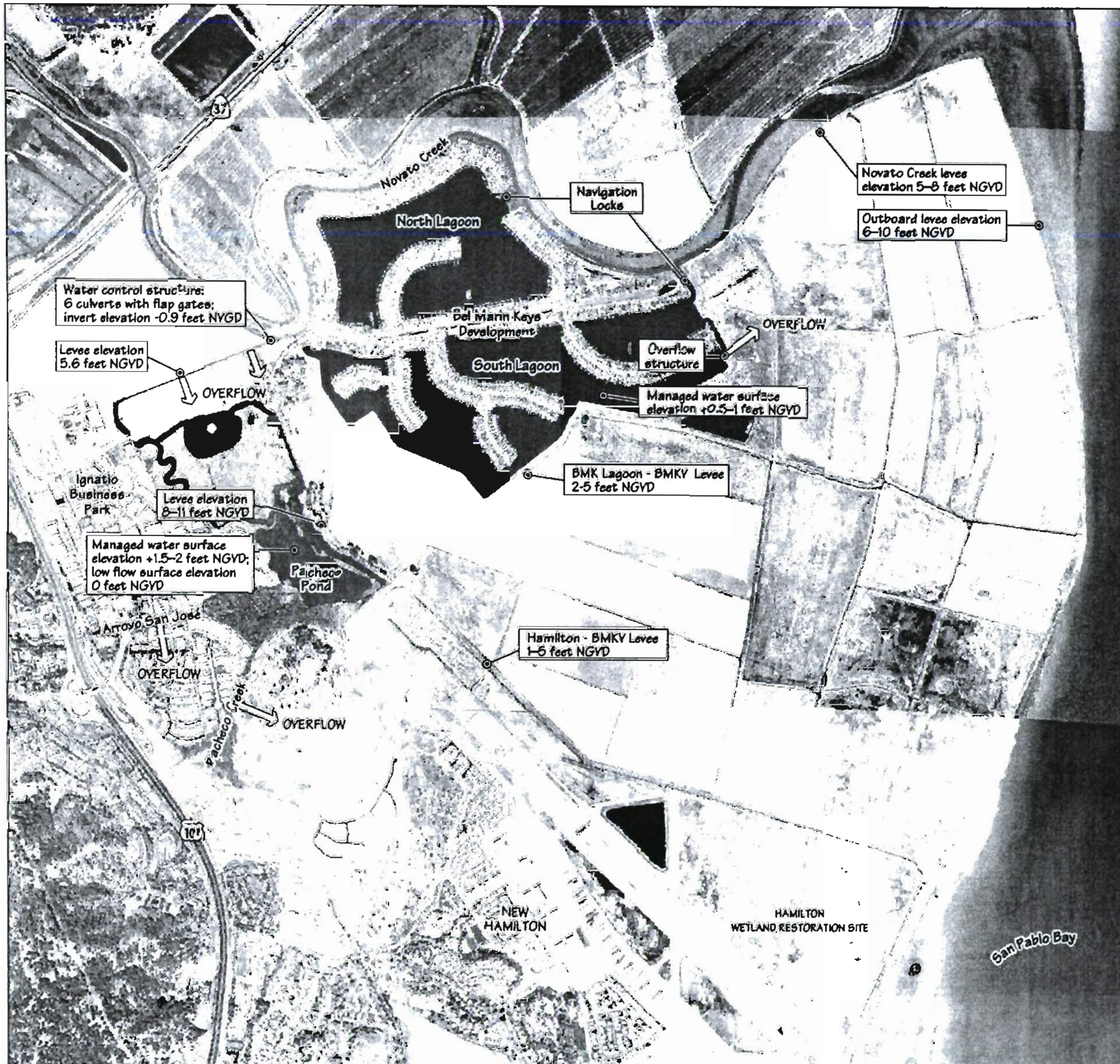

Figure 1
Hydrologic Setting at the Project Site

Jones & Stokes   nhc

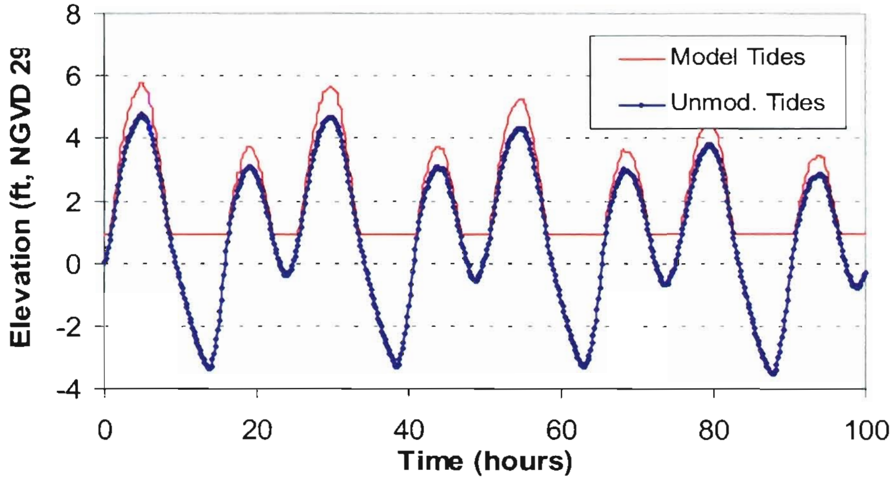

Figure 2. Unmodified tide series, and tide series used in UNET model

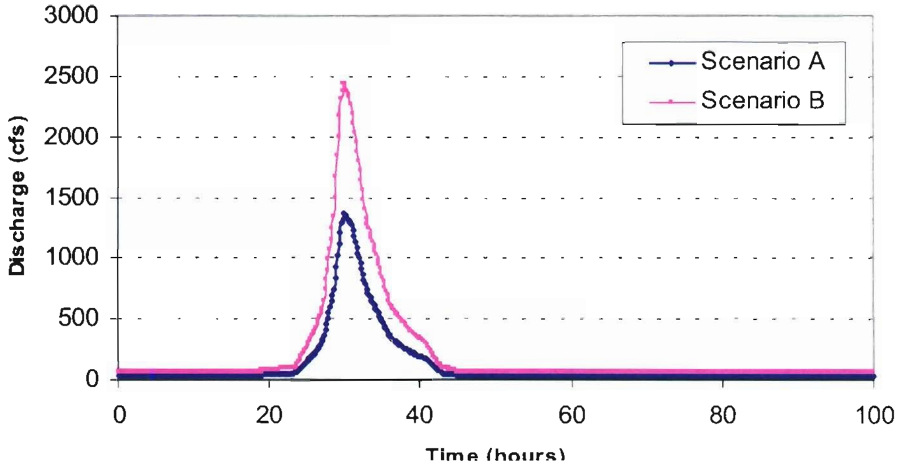

Figure 3. Arroyo San Jose Input Hydrographs

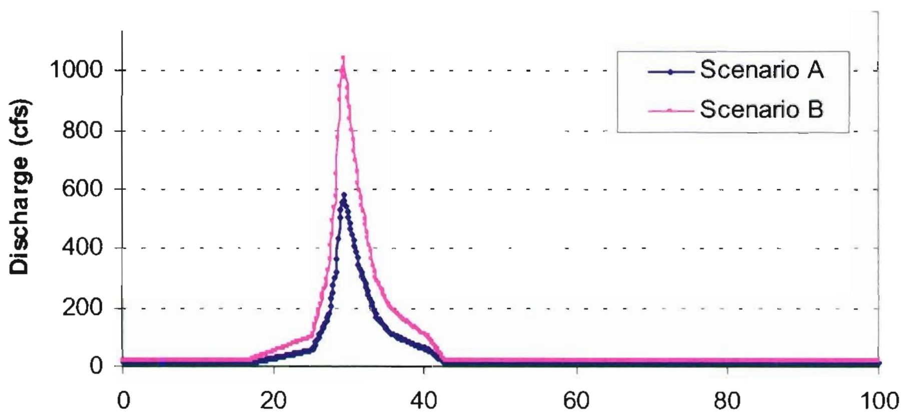

Figure 4. Pacheco Creek Input Hydrographs

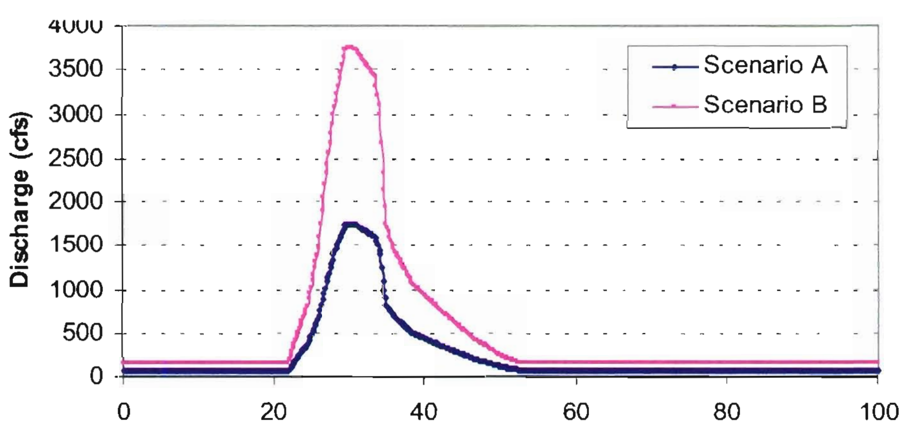

Figure 5. Novato Creek Input Hydrographs (0-hour lag)

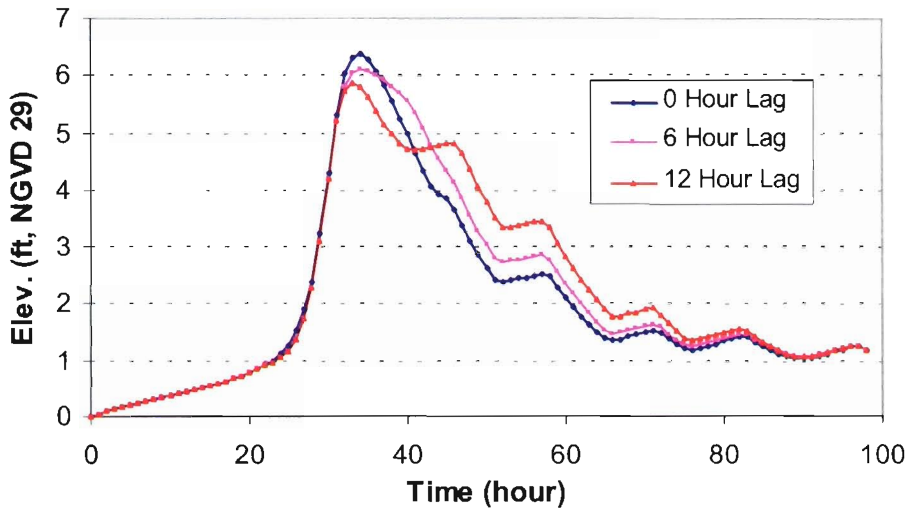

Figure 6. Pacheco Pond water surface elevations, existing conditions, Scenario A

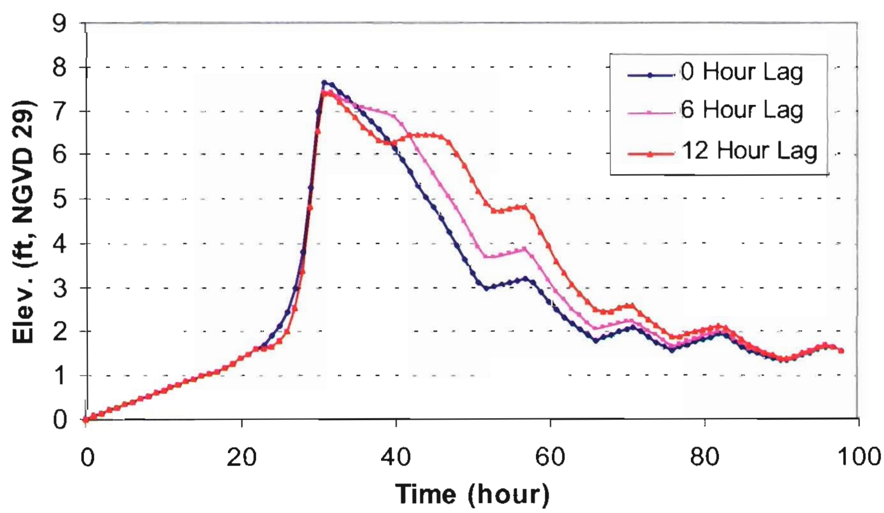

Figure 7. Pacheco Pond water surface elevations, existing conditions, Scenario B

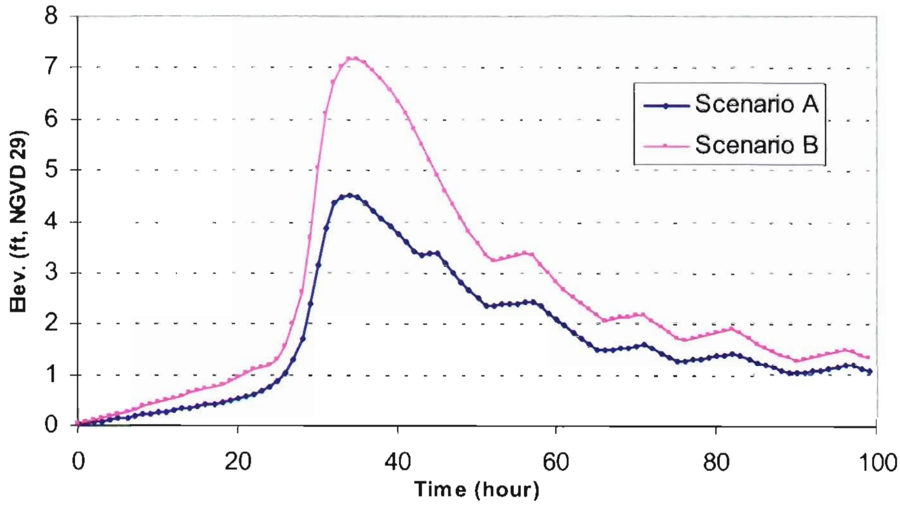

Figure 8. Pacheco Pond water surface elevations, Alternatives 1 & 3

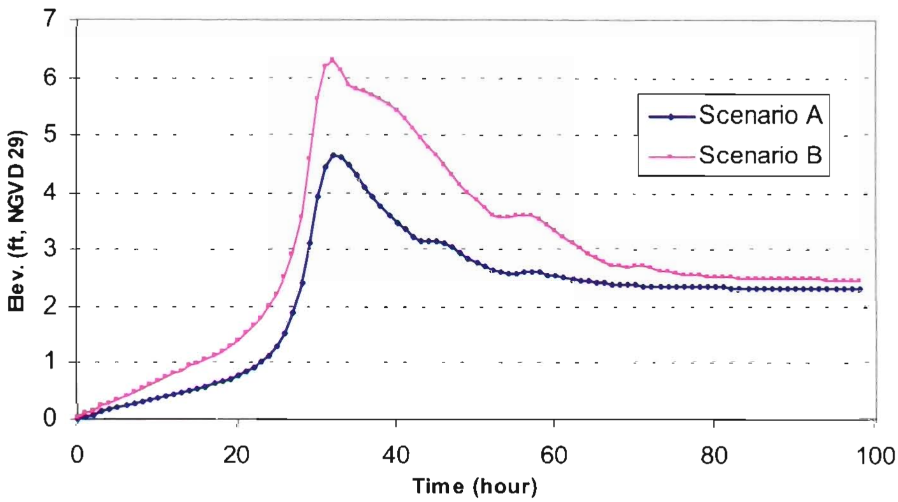

Figure 9. Pacheco Pond water surface elevations, Alternative 2

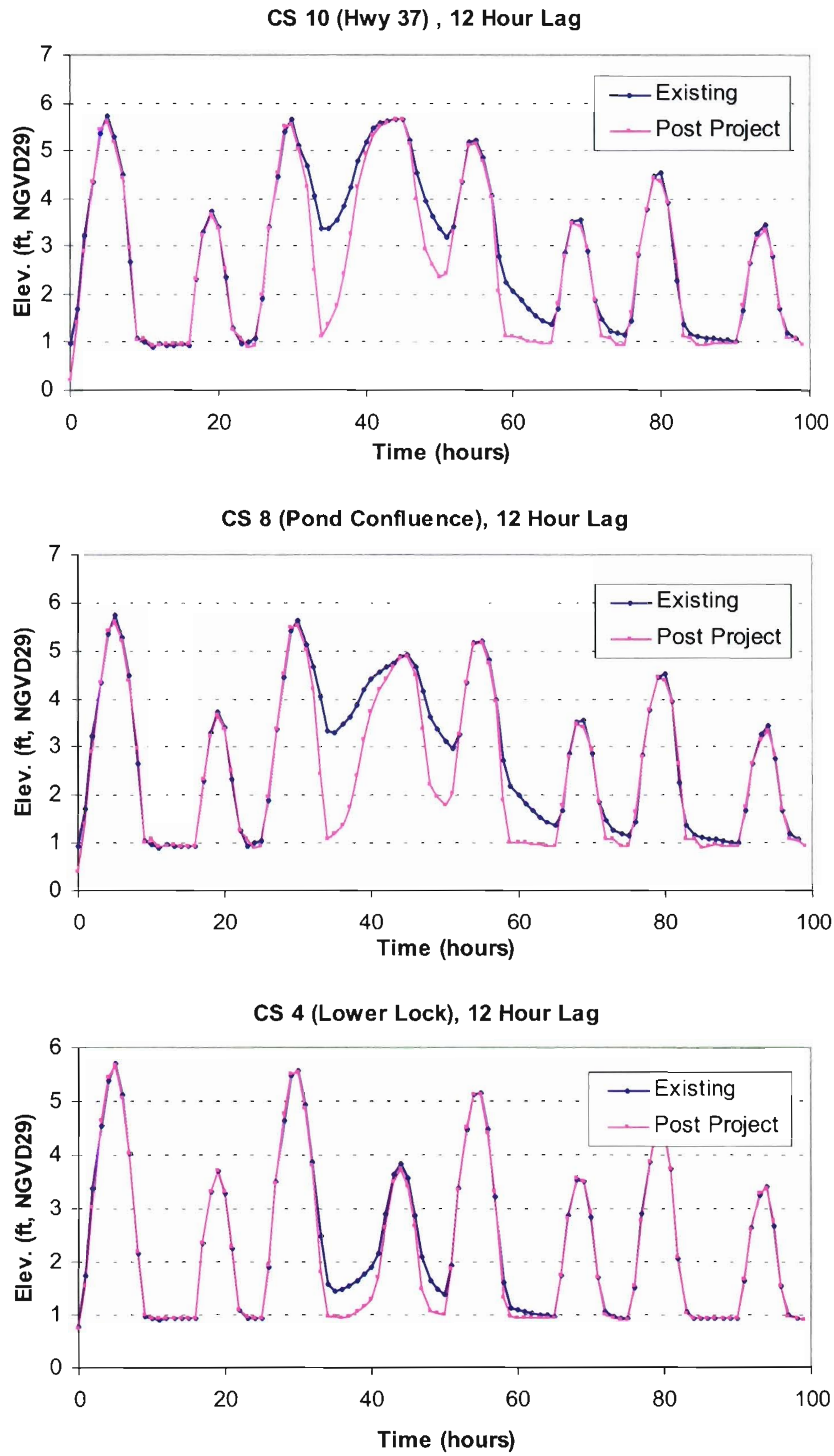

Figure 10. Stage hydrographs at select locations along Novato Creek, Scenario A

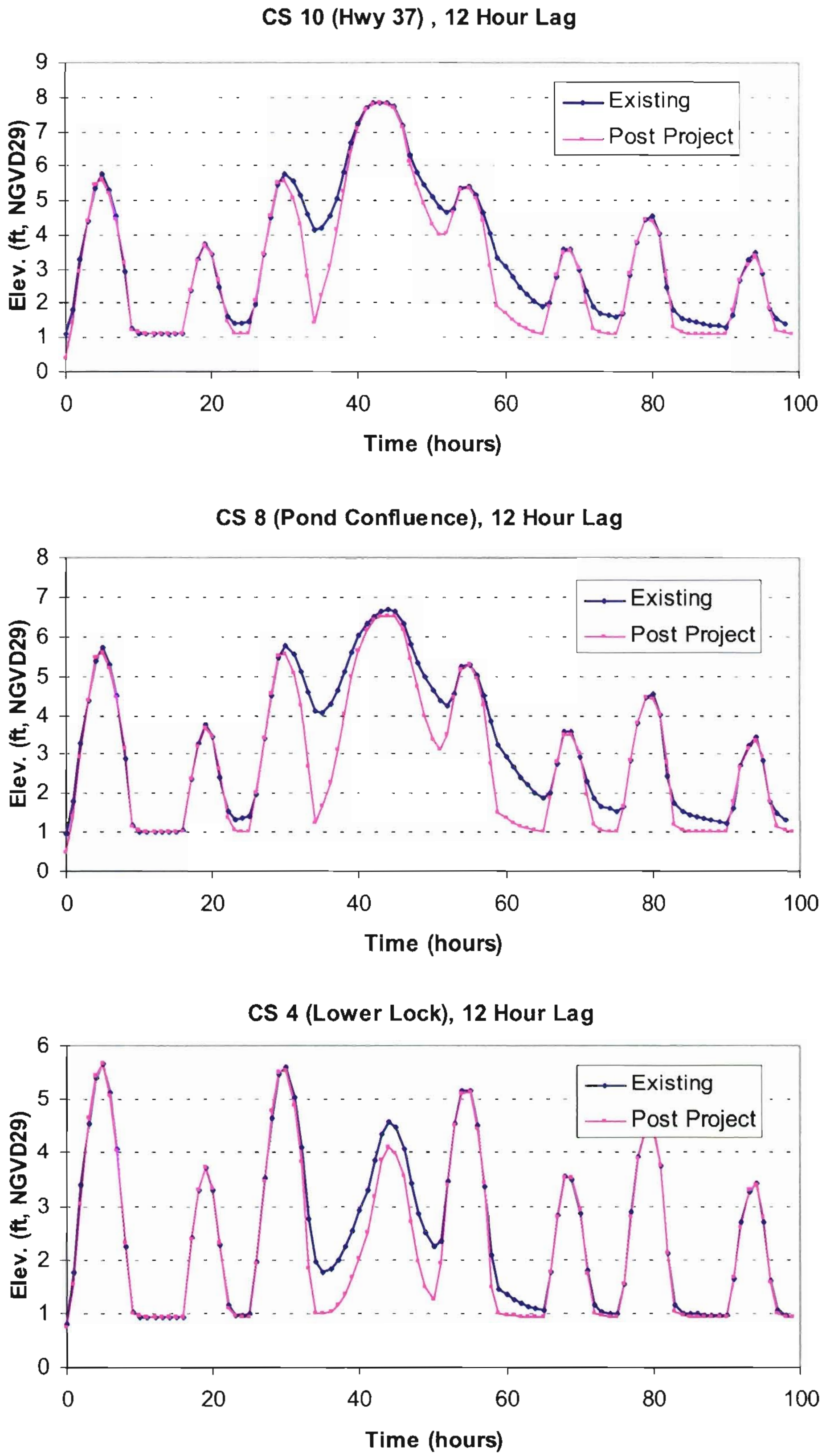

Figure 11. Stage hydrographs at select locations along Novato Creek, Scenario B

Bel Marin Keys Unit V Expansion of the Hamilton Wetland Restoration Project

Hydraulic Routing Analysis

Purpose
This document presents a hydraulic impact investigation performed by Northwest Hydraulic Consultants (**nhc**) of the proposed Bel Marin Keys tidal marsh restoration project on Pacheco Pond and Novato Creek. The purpose of the study was to quantify the relative hydraulic effects of the proposed project on Pacheco Pond and on Novato Creek from the Pacheco Pond outlet to San Pablo Bay.

This document describes supplementary hydrologic and hydraulic analyses initially presented in the technical memorandum entitled "Hydrologic and Hydraulic Modeling Assessment of Existing and Project Alternatives at Bel Marin Keys," dated April 18, 2002 (**nhc**, 2002a). Supplementary information presented in the following sections of this report includes a refinement of the geometric conditions for Alternative 2, as well as an assessment of additional scenarios for evaluating the effects of Pacheco Pond on existing and project alternative conditions on Novato Creek flood dynamics. Computed time histories of channel velocity, flow rate, and water surface stage for several hydrologic scenarios are also presented in this report.

Background
Over the last two centuries, hydrologic conditions in the Novato Creek watershed below Highway 37 have varied dramatically due to changes in land use practices and engineered modifications to the land surface. These modifications include the construction of flood protection levees, the development of Pacheco Pond as a flood detention system, and the rerouting of drainage channels and installation of flap gates on Simmons Slough and Pacheco Pond. This has decreased the tidal prism of lower Novato Creek significantly, and has resulted in accretion of the channel. The reduction in channel size due to accretion has decreased the flood capacity of the system and has proved undesirable for navigation. The creek is constantly evolving toward a smaller width and depth consistent with the reduced tidal prism. Actions to counter the effects of channel accretion include the periodic surveying and raising of levees along the north side of Novato Creek from Highway 37 to the mouth and dredging of Novato Creek downstream of its confluence with Pacheco Pond.

Hydraulic Setting
Novato Creek is the principal drainage in the vicinity of the project site and has an approximate total watershed area of 44 square miles. Two smaller drainages, Arroyo San Jose (drainage area of 5.4 square miles) and Pacheco Creek (drainage area of 1.9 square miles) discharge into Pacheco Pond. The pond ultimately drains into Novato Creek by means of six 4-foot by 4-foot flap gates. The flap gates open when the stage in Pacheco Pond exceeds the stage in Novato Creek and the invert of the flap-gate culvert, which is approximately -0.86 feet NGVD 29. In addition, Simmons Slough drains lowlands to the north of Novato Creek and discharges into Novato Creek through a flap gate culvert downstream of the Pacheco Pond culvert.

The Bel Marin Keys Community Service District (CSD) operates two locks that provide recreational vessel access to the North and South Lagoons of the community. The North Lock facility includes three tainter gates used for lagoon flushing purposes. Managed releases from the lagoons are conducted by the CSD to promote channel scour in Novato Creek to improve navigability of the tidally influenced portion of Novato Creek. A location map showing the project site and adjacent areas is provided in Figure 1.

Downstream of Highway 101, the geometry of Novato Creek is characteristic of tidally influenced channels throughout San Francisco Bay, and is composed of a consolidated bay mud main channel with tidal salt marsh benches. The slope of the lower channel is relatively mild, with a general longitudinal slope of

0.002 ft/ft between Highway 101 and Diablo Avenue to approximately 0.0001 ft/ft near the mouth. These slopes result in subcritical flows throughout the lower reach, even during storm events. However, critical and supercritical flows may occur in discrete locations during low tide conditions.

Novato Creek transitions from channel-control to tidal-control within this reach, as the slope of the creek reduces and the creek elevations come within San Pablo Bay tidal range. Tidal effects from San Pablo Bay become apparent and influence the stage of the creek, as the creek stage rises and falls with the tidal stage in San Pablo Bay. The location of the transition point from channel- to tidal-control varies with the magnitude of terrestrial inflows and tide stage characteristics.

Channel conveyance, and thus discharge capacity, in lower Novato Creek is directly related to the tide level. Since both the tide stage and inflows to Novato Creek vary with time, the channel conveyance also varies in time. Furthermore, since conveyance is a function of both terrestrial inflow and tide, peak stages in lower Novato Creek do not necessarily occur during the peak flow. The time-dependant effects of the changing inflows and tide (referred to as hydraulic boundary conditions) necessitate the application of a dynamic model to properly simulate the physical processes of tidally influenced, unsteady creek flow.

Although tidally influenced systems are unsteady by nature, steady-state hydraulic models, or models in which the boundary conditions do not vary with time, can be used to conservatively estimate water surface profiles and discharge in tidal channels. Steady-state models are simpler to operate and were more commonly applied prior to the advent of modern personal computers. Using HEC-2, a steady-state model developed by the Corps of Engineers, FEMA calculated a maximum channel conveyance capacity downstream of Highway 37 of 2,500 cfs (FEMA, 1989). It is worth noting that this is significantly less than the effective 10-year peak discharge of 3,420 cfs discharge published in the City of Novato FIS (FEMA, 1989).

The 1984 City of Novato Flood Insurance Rate Map published by FEMA indicates a nearly flat water surface coincident with the peak 100-year tidal stage in the lower reach of Novato Creek, revealing the dominance of tidal flooding over terrestrial flooding in Novato Creek downstream of Highway 37 for the one percent annual exceedance probability (100-year recurrence interval) flood. These predicted tide stages are based on tide stage frequency analyses conducted by the Corps. The 1989 City of Novato FIS rounds the Corps tidal flood stage of 6.5 feet NGVD 1929 to 7 feet NGVD 29 as per FEMA mapping guidelines (FEMA 2002).

Tides in San Pablo Bay follow a mixed semidiurnal cycle, with two high and two low tides, of differing heights, occurring in a single day. Due to geographic and hydrodynamic complexities, mean tide levels vary throughout the San Francisco Bay. Tide cycles in San Pablo Bay lag those at the Golden Gate Bridge by as much as 75 minutes. Peak tide levels in the vicinity of Novato Creek are 6.0 ft NGVD 29 for the 10-year tide and 6.5 ft NGVD 29 for the 100-year tide (San Francisco District, 1984).

Storm events may lead to higher tidal stages than those predicted by gravitational forces for a variety of reasons. First, low barometric pressures associated with significant storms can cause an increase in tidal stage, as the ocean's surface level increases in response to the barometric low. Second, strong wind shear may push water towards land, leading to the phenomenon of a storm surge. Third, increases in large-scale regional runoff from the Sacramento and San Joaquin watersheds, as well as contributions from San Francisco Bay watersheds, can limit the low tidal excursion of normal tidal cycles. San Pablo Bay, for instance, is filled mainly by regional runoff and runoff from the Sacramento and San Joaquin River systems (Anderson et al., 2000).

Model Selection

The hydraulic modeling program UNET was utilized to evaluate the existing hydraulic conditions of lower Novato Creek, as well as evaluate the hydraulic conditions for the proposed project conditions. UNET is a one-dimensional model, developed by the U.S. Army Corps of Engineers, and provides a modeling framework for computing solutions to unsteady flow problems in channel networks. UNET also provides routines for evaluating levee overflow to floodplain storage, stage-discharge routing of bridges, culverts

and flap-gate culverts, and routing hydraulic linkages between main channel conveyance and overbank floodplain storage. These features make UNET an ideal tool for simulating the dynamic conditions within Novato Creek, as fluctuating tide levels in San Pablo Bay and the time dependent nature associated with storm hydrographs result in spatially and temporally variable hydraulic conditions. In addition, the relatively confined flow conditions exhibited by the Pacheco Pond-Novato Creek system are conducive to a one-dimensional analysis where connections between the main channel and storage areas are easily defined by discrete channel links. Finally, the use of UNET in a tidal environment is consistent with Corps and FEMA Guidelines (FEMA 2002). FEMA approves the use of one-dimensional unsteady flows in channel networks where flow reversals may occur and flood storage capacity must be considered.

Study Limits

The study domain used to assess the impacts of the proposed project alternatives extends from the mouth of Novato Creek upstream approximately 4 miles to the downstream face of the railroad bridge near Highway 37. Subcritical reaches are subject to downstream control, meaning that the hydraulic characteristics of a given cross section can affect stages that occur upstream. However, the distance that this effect propagates upstream is limited by channel slope and friction. This implies that if no increase in water surface elevation is calculated at the upstream study limit, then there will not be any increase in channel stage upstream of the study limit.

UNET Model Structure

UNET is an open channel network model that requires geometric data, friction coefficients, and boundary conditions as input. Using these input variable, the model solves the one-dimensional unsteady flow equations and calculates the flow magnitude and direction, water surface elevation at each cross section, and the storage characteristics of each storage area. For the impact analyses, the model geometry and boundary conditions are based on existing data.

Geometry

The study reaches include Pacheco Pond, Novato Creek, and the Bel Marin Keys V site. Network model geometries were developed by **nhc** from existing Light Detection and Radar (LiDAR), levee, and bathymetric surveys (Towill 1996). Since the model is designed to identify relative changes in hydraulic characteristics due to project features, several simplifying assumptions were made regarding Novato Creek's and Pacheco Pond's connections to adjacent areas. These include the assumption that flow from Novato Creek could only pass to the BMK V site and from Pacheco Pond through the flap gate connection. This allows for easily tracking changes in water surface elevations in Novato Creek due to project modifications by not simulating overtopping of levees into other adjacent areas such as the Antenna Fields north of Novato Creek. Furthermore, this assumption provides a conservative means to identify the project features' influence on water surface elevations.
The volume of flow overtopping the levee separating Pacheco Pond and the BMKV (at an elevation between 6 and 7 feet NGVD29) was investigated during initial sensitivity analyses. Approximately 14.4 acre-feet were calculated to flow over the levee into the BMKV site for the existing conditions geometry in Inflow Scenario A. This volume is approximately 0.6 percent of the inflowing volume to Pacheco Pond during Inflow Scenario A. Based on this analysis, weir flow over the levee was determined to be negligible with respect to the overflow volume's potential to increase flood stages.

Four geometric scenarios were developed to identify impacts on hydraulic characteristics along Novato Creek. These scenarios are summarized listed in Table 1 and graphically depicted in network schematic diagrams on Figure 2.

Water surface elevation and storage in Pacheco Pond and the Bel Marin Keys V site were simulated as storage areas in the UNET model. A lateral weir between Novato Creek and the Bel Marin Keys V site was defined to compute overflow and storage on the project site for existing conditions. From the existing LiDAR and survey data, cross sections, storage area stage-volume relationships, and lateral weir characteristics were defined. Using the LiDAR data, the Pacheco Pond storage volume between 0 and 7 feet NGVD was calculated to be 880 ac-ft. This volume is same as reported in Appendix IV in the Final Environmental Impact Report for Ignacio Industrial Park, Unit 3 (Madrone 1975) between 0 and 7 feet

MSL. Due to the ongoing changes in the terrain resulting from subsidence and channel evolution, it is not possible, nor is it necessarily required, to define present day geometric conditions precisely to identify the hydraulic impacts of the project on Novato Creek and Pacheco Pond.

The cross sections used in the model include the subtidal channel of the creek, adjacent marsh floodplain, and the existing levee structures. A cross section layout is shown in Figure 1. Top of levee surveys completed in 1996 (Towill 1996), indicate that the levee crest between Novato Creek and the Bel Marin Keys V site dips to an elevation of approximately 5.6-ft, NGVD 29, at a point approximately 1000 feet downstream from the Bel Marin Keys South Lagoon navigation lock. Overtopping of this levee was observed by Bel Marin Keys residents during the February 1998 flood event. Levee surveys of the Pacheco Pond outlet channel reveal low points at 5.6 and 6.7 ft NGVD 29. Based on these data, the baseline geometric condition considers the following features:

- Six 4-ft tall by 4-ft wide, unidirectional box culvert controls flow from Pacheco Pond to Novato Ck;
- 100-ft wide lateral weir at 5.6-ft, NGVD 29 for pond overflow into Novato Creek on Leveroni Parcel
- 1000-ft wide lateral weir at 6.7-ft, NGVD 29 for pond overflow into Novato Creek on Leveroni Parcel;
- 300-ft wide lateral weir at 5.6-ft, NGVD 29 for Novato Ck overflow to BMKV site approximately 1000 feet downstream of BMK community.

Table 1. Novato Creek Geometric Scenarios

Scenario	Model Conditions
Scenario 1: Existing Novato Creek and Pacheco Pond Network - **Evaluates the interaction between Pacheco Pond and Novato Creek for existing conditions**	Model Elements • **Six 4-ft tall by 4-ft wide, unidirectional box culvert controls flow from Pacheco Pond to Novato Ck;** • **100-ft wide lateral weir at 5.6-ft, NGVD 29 for Pacheco Pond overflow to Novato Creek on Leveroni parcel** • **1000-ft wide lateral weir at 6.7-ft, NGVD 29 for Pacheco Pond overflow to Novato Creek on Leveroni parcel** • **300-ft wide lateral weir at 5.6-ft, NGVD 29 for Novato Ck overflow to BMKV site approximately 1000 feet downstream of BMK community**
Scenario 2: No Pacheco Pond Outlet to Novato Creek and a Design Breach along BMKV -	Model Elements • **Pacheco Pond disconnected from Novato Creek;** • **right bank levee removed downstream of BMK Development** • **right bank floodplain expanded laterally by 1000-ft downstream of BMK Development to reflect opportunity for overflow into restored tidal marsh** • **600-acre tidal marsh modeled as storage area with hydraulic connection through new breach channel to lower Novato Creek.**
Scenario 3: Pacheco Pond Outlet to Novato Creek and a Design Breach -	Model Elements • **100-ft wide lateral weir at 5.6-ft, NGVD 29 for Pacheco Pond overflow to Novato Creek on Leveroni parcel** • **1000-ft wide lateral weir at 6.7-ft, NGVD 29 for Pacheco Pond overflow to Novato Creek on Leveroni parcel** • **Six 4-ft tall by 4-ft wide, unidirectional box culvert controls flow to tidal marsh** • **right bank levee removed downstream of BMK Development** • **right bank floodplain expanded laterally by 1000-ft downstream of BMKV swale to reflect opportunity for overflow into restored tidal marsh** • **600-acre tidal marsh modeled as storage area with hydraulic connection through new breach channel to lower Novato Creek.**
Scenario 4: No Pacheco Pond Outlet and No Design Breach along BMKV -	Model Elements • Connections between Pacheco Pond and Novato Creek Removed.

Hydraulic parameters in Pacheco Pond were estimated from geometric Scenarios 1, 3, 5, and 6. In Alternatives 1, 2, and 3 Pacheco Pond drains to the BMKV site and the outlet to Novato Creek is closed. Alternatives 1 and 3 were simulated by Geometric Scenarios 5 and Alternative 2 was simulated by Geometric Scenario 6. These scenarios are summarized in Table 2.

Scenario	Model Conditions
Scenario 5: Pacheco Pond Configuration for Alternatives 1 and 3 - **Evaluates an expanded Pacheco Pond with a flap gate outlet to the tidal marsh**	Model Elements • **Six 4-ft tall by 4-ft wide, unidirectional box culvert controls flow from Pacheco Pond to tidal marsh;** • **Pacheco Pond expanded to increase the pond surface area by 74 ac.**
Scenario 6: Pacheco Pond Configuration for Alternative 2 - **Evaluates an expanded Pacheco Pond with an adjacent seasonal marsh storage area, flow controlled by weir and flap gate structure**	Model Elements • **100 -ft weir controls flow from Pacheco Pond to seasonal wetland;** • **Six 4-ft tall by 4-ft wide, unidirectional box culvert controls flow from seasonal wetland to tidal marsh** • **Seasonal wetland surface area 135 ac** • **Pacheco Pond surface area expanded by 32 ac.**

Boundary Conditions

Boundary conditions were developed at the upstream and downstream study limits. Two inflow scenarios were modeled loosely representing the 10- and 100-year flow events for existing conditions. Hydrologic Scenarios A and B use published 10-year and 100-year flood event hydrographs, respectively, from two previous Corps of Engineers studies (Corps of Engineers 1987, PWA 1998).

Tide measurements taken at the mouth of the Petaluma River were utilized to develop time series of tidal stage hydrographs at the mouth of Novato Creek. These data, completed as part of the San Francisco Airport runway expansion dredge material disposal studies, consist of tidal stage measurements recorded at 10-minute increments for approximately one month duration (14 June - 17 July 2000). Previous studies of Novato Creek indicate negligible differences between Novato Creek and Petaluma River tidal stage characteristics (PWA, 1998). To conservatively estimate tidal conditions during flood events, the tide data were modified in two ways to reflect extreme tidal conditions that occur during significant flood events. The first modification was to increase the observed peak tidal stage by one foot to reflect extreme high tides due to low atmospheric pressure and wind setup in the region. This is equivalent to coincident tidal stage boundary conditions frequently used by the Corps of Engineers and the FEMA for flood control design or flood hazard mapping studies on tidally influenced streams and rivers in the San Francisco Bay Area. The resulting peak tide was calculated to be 5.75 ft NGVD 29, 0.25 feet lower than the 10-year peak tide. The second modification was to truncate the low tide elevation at the mean tide level to represent limits on low tide excursion due to extreme regional, basin-wide runoff conditions (Anderson et al, 2000). The resulting tidal boundary condition is shown in Figure 3.

Theoretically, there are infinite phasing combinations between the peak tide elevation and the peak discharge hydrographs. To simplify the analysis, Pacheco Creek and Arroyo San Jose hydrographs were phased to be coincident with the higher high water tidal stage for all model runs. However, the phasing of the Novato Creek hydrograph was varied to investigate the effect of lag times on system. Due to the larger watershed dimensions, the peak discharge from Novato Creek would be expected to lag the Pacheco Pond peak discharges. Novato Creek hydrographs were developed using three different lag times relative to the peak hydrograph from the Pacheco Pond watershed: 0-hour lag time (i.e. coincident with the higher high water tide stage and other hydrographs), 6-hour lag time (i.e. 6 hours behind other hydrographs), and 12-hour lag time. The adjustment of phasing was only relevant to the model runs that evaluated the existing conditions, as Pacheco Pond flows are routed away from Novato Creek for all project condition scenarios.

Loss Coefficients

Channel friction is expressed in UNET using Manning's equation. The Manning's roughness coefficient was set at 0.02 for the subtidal channel and 0.04 for the salt marsh benches. These values were adopted

from calibrated UNET models of Sonoma Creek developed as part of the mitigation planning for the San Francisco Airport runway expansion studies.

Model Scenarios

Four geometric scenarios were run for each of the hydrologic flow scenarios to assess project impacts on Novato Creek. Pacheco Pond was connected to Novato Creek in scenarios 1 and 3. Two additional geometric scenarios of Pacheco Pond (scenarios 5 and 6) were defined to evaluate the impacts to Pacheco Pond water surface elevations by the project alternatives. In these scenarios the flap gate connection between Pacheco Pond and Novato Creek was closed, thus identifying the effects of diverting all flow to Bel Marin Keys V project site. However, it should be noted that a new water management scenario envisioned by the project includes dual use of the existing and new outlets to enhance water quality in Pacheco Pond. Project Alternatives 1 and 3 were modeled as one scenario and Alternative 2 was modeled as a separate scenario. The conditions for Pacheco Pond draining directly to the Bel Marin Keys V site are modeled as Scenarios 5 and 6, respectively. The characteristics of the geometric model scenarios are summarized in Table 2. Schematic diagrams of the hydraulic connections and storage areas are shown in Figure 2.

Table 2. Geometric Model Scenarios

Scenario	Description
1	Existing conditions Novato Creek connected to Pacheco Pond. No design breach between Novato Creek and BMKV
2	Alternative 2 No connection between Novato Creek and Pacheco Pond Design breach between Novato Creek and BMKV
3	Novato Creek connected to Pacheco Pond. Design breach between Novato Creek and BMKV
4	No connection between Novato Creek and Pacheco Pond No design breach between Novato Creek and BMKV
5	No connection between Novato Creek and Pacheco Pond Pacheco Pond expansion Pacheco Pond outlet to BMKV as described in Project Alternatives 1 and 3
6	No connection between Novato Creek and Pacheco Pond Pacheco Pond connected to expanded pond and seasonal wetland as described in Revised Alt. 2 Seasonal Wetland outlet to BMKV as described in Revised Alternative 2

Model Results

Summarized below are the model results for the hydraulic routing analyses. Values presented in the results section are intended for comparison purposes to identify relative changes in hydraulic parameters between project elements (i.e. Pacheco Pond removal and/or design breach). Comparisons of water surface stage, velocity, and flow were made between Geometric Scenarios for a each flow condition.

Project Impacts to Novato Creek Stage -The project's impact on stage was evaluated by reviewing time series of computed stage data at three locations along Novato Creek; the proposed design breach location (Section 2.8), downstream of the Pacheco Pond outlet (Section 8 ds), and at the upstream model cross section immediately downstream of Highway 37 (Section 10). Scenario 1, which is equivalent to existing conditions on Novato Creek with a flap gate connection to Pacheco Pond and no design breach to the Bel Marin Keys V site, was used as the baseline condition from which comparisons with Scenarios 2 through 4 were made. The comparisons are described below.

- **Impact of levee breach** - Addition of the design breach to the baseline condition modeled in Scenario 3 produces negligible changes in water surface elevations (i.e. 0.25 feet or less) at

Sections 2.8, 8 ds, and 10. The time series histories are shown on Figures 4 and 5 for Inflow Conditions A and B, respectively.

- **Impact of rerouting Pacheco Pond connection to Bel Marin Keys V project site** – Removal of Pacheco Pond in Scenario 2 reduced the flow into Novato Creek and increased the magnitude of flow recession during ebb tides. A small (<0.25 foot) reduction in peak water surface elevation was also computed at all points on Novato Creek. These results are summarized in Table 3.

The computed stage for Scenarios 1 and 3, Pacheco Pond connected to Novato Creek, are similar at Sections 2.8, 8 ds, and 10 as are Scenarios 2 and 4, without Pacheco Pond connected to Novato Creek. The rapid stage recession computed in Scenarios 2 and 4 results from the reduced flow into Novato Creek from Pacheco Pond. These observations hold true for both Inflow Condition A and B.

Table 3. Summary of Maximum Stages

Scenario	Flow Condition A			Flow Condition B		
	Sec 2.8 Stage, ft	Sec 8 d/s Stage, ft	Sec 10 Stage, ft	Sec 2.8 Stage, ft	Sec 8 d/s Stage, ft	Sec 10 Stage, ft
1	5.69	6.13	6.55	5.69	7.26	8.09
2	5.64	6.12	6.54	5.69	7.00	7.98
3	5.64	6.12	6.54	5.64	7.13	8.03
4	5.69	6.13	6.52	5.68	7.04	7.99

Project Impacts to Novato Creek Velocity - Impacts due to Pacheco Pond and the design breach on channel velocity were assessed in a similar manner as the stage impacts, and are summarized below.

- **Impact of levee breach** – The levee breach connection to the restored tidal wetland in Scenarios 2 and 3 shows a large change in the computed velocity time series at Section 2.8, located immediately downstream of the levee breach, when compared with Scenario 1. Higher magnitude ebb and flood velocities are created by increasing the tidal prism of the restored tidal wetland and connecting this tidal prism to Novato Creek. The levee breach has no appreciable effect on velocity magnitudes upstream of the design breach at Sections 8 ds and 10. A summary of the peak velocities calculated for each scenario is provided in Table 4. Time series are shown in Figure 6 and 7 for flow scenarios A and B, respectively.

- **Impact of removing Pacheco Pond** – Removal of Pacheco Pond flood flows to Novato Creek has a negligible impact of peak velocities (less than 0.5 fps) at Sections 8 and 10. The velocity time series at these locations indicate a more rapid recession of velocities when Pacheco Pond flows are removed from the Novato Creek system.

Table 4. Summary of Maximum Velocity

	Flow Condition A			Flow Condition B		
Scenario	Sec 2.8 Vel, fps	Sec 8 d/s Vel, fps	Sec 10 Vel, fps	Sec 2.8 Vel, fps	Sec 8 d/s Vel, fps	Sec 10 Vel, fps
1	3.72	4.04	4.24	4.93	5.40	5.85
2	5.30	3.20	4.41	5.33	5.47	5.97
3	5.33	3.91	4.41	5.32	5.47	5.97
4	3.53	3.31	4.26	4.78	5.26	5.88

Project Impacts to Novato Creek Flow Rate - Impacts due to Pacheco Pond and the design breach on channel flow rate were assessed in a similar manner as the stage impacts and velocity impacts, and are summarized below.

- **Impact of levee breach** – As shown in Figures 8 and 9, the levee breach has no appreciable effect on flows at Sections 8 ds and 10. Downstream of the design levee breach (Section 2.8), the computed flow rate for both ebb and flood tide conditions on Novato Creek increases due to the draining and filling of the tidal prism in the proposed tidal wetland.

- **Impact of removing Pacheco Pond** – Removal of Pacheco Pond flows reduces the peak flow on Novato Creek at Section 2.8 and 8 ds, as summarized in Table 5. These reductions in flow and volume are shown in the flow time series histories on Figures 8 and 9.

Table 5. Summary of Peak Novato Creek Flow

	Flow Condition A			Flow Condition B		
Scenario	Sec 2.8 Flow, cfs	Sec 8 d/s Flow, cfs	Sec 10 Flow, cfs	Sec 2.8 Flow, cfs	Sec 8 d/s Flow, cfs	Sec 10 Flow, cfs
1	3230	2180	1740	4710	3870	3740
2	5180	1760	1740	5910	3490	3740
3	5180	2140	1740	5180	3810	3740
4	3270	1770	1740	4460	3480	3740

Project Impacts to Pacheco Pond Stage – The stage of Pacheco Pond was computed for all geometric and hydrologic scenarios. The proposed rerouting and expansion of Pacheco Pond substantially reduces the peak water surface elevation within Pacheco Pond (Table 6). Reducing stage in Pacheco Pond would improve the drainage of Ignacio Business Park and other low-lying areas adjacent to lower Arroyo San Jose, such as the nearby trailer park. The magnitude and extent of this improvement, however, was not quantified in this analysis.

Table 6. Peak Water Surface Elevations in Pacheco Pond (ft, NGVD 29)

Case	Scenario A	Scenario B
Existing	6.4	7.6
Alternative 1 & 3	4.5	7.2
Revised Alternative 2	4.6	6.3

The volume of water overtopping the Bel Marin Keys V levee from Novato Creek during the Scenario 1 (existing condition) Flow Condition A, which loosely represents the current 100-year Novato Creek flood, is 5 ac-ft. The duration of overtopping is less than 2 hours and has a peak discharge over the levee top of less than 60 cfs. The flow overtopping into the BMKV site during Scenario 1 Flow Condition A is less than 0.2 percent of the inflow hydrograph at the upstream Novato Creek boundary (Section 10).

Conclusion

The proposed levee breach and potential diversion of Pacheco Pond inflows reduces peak water surface stages in Novato Creek. The proposed tidal wetland connection to Novato Creek slightly increases channel velocity downstream of the proposed levee breach. Rerouting of Pacheco Pond reduces the duration of high velocities above the levee breach during the infrequent flood flows (approximately 1 in 10 or 100 years) modeled for this study. As described in the memorandum titled *Novato Creek Geomorphic and Hydraulic Modeling Technical* (**nhc** 2002b) hydraulic properties associated with daily tidal cycles are the dominant influence on tidal channel morphology. The proposed project will have no measurable impact on tidal hydraulics upstream of the design breach and will increase the tidal prism downstream of the design breach. This increase in tidal prism results in an increase in the channel dimensions downstream of the breach. The results indicate a reduction in stage on Novato Creek for all project conditions. The project alternatives all resulted in a reduction in flood stage on Novato Creek. The volume of overtopping into the BMKV levee from Novato Creek under existing conditions is negligible, and has no measurable impact on flood stage reduction on Novato Creek.

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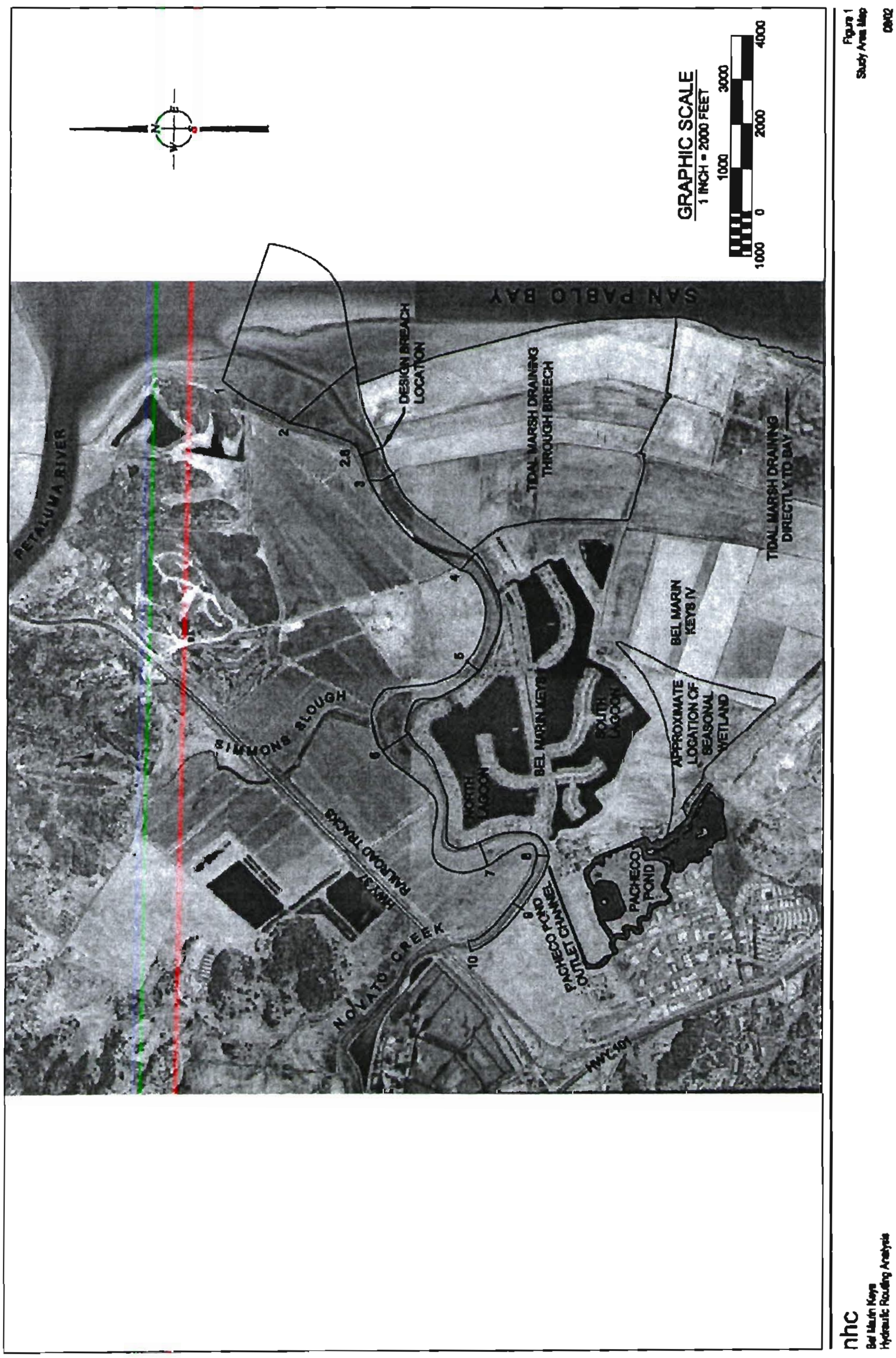

PETALUMA RIVER
SAN PABLO BAY
DESIGN BREACH LOCATION
TIDAL MARSH DRAINING THROUGH BREECH
TIDAL MARSH DRAINING DIRECTLY TO BAY
BEL MARIN KEYS IV
APPROXIMATE LOCATION OF SEASONAL WETLAND
SOUTH LAGOON
BEL MARIN KEYS
NORTH LAGOON
SIMMONS SLOUGH
RAILROAD TRACKS
HWY 37
NOVATO CREEK
PACHECO POND OUTLET CHANNEL
PACHECO POND
HWY 101
GRAPHIC SCALE
1 INCH = 2000 FEET
1000 0 1000 2000 3000 4000
Figure 1
Study Area Map
nhc
Bel Marin Keys
Hydraulic Routing Analysis

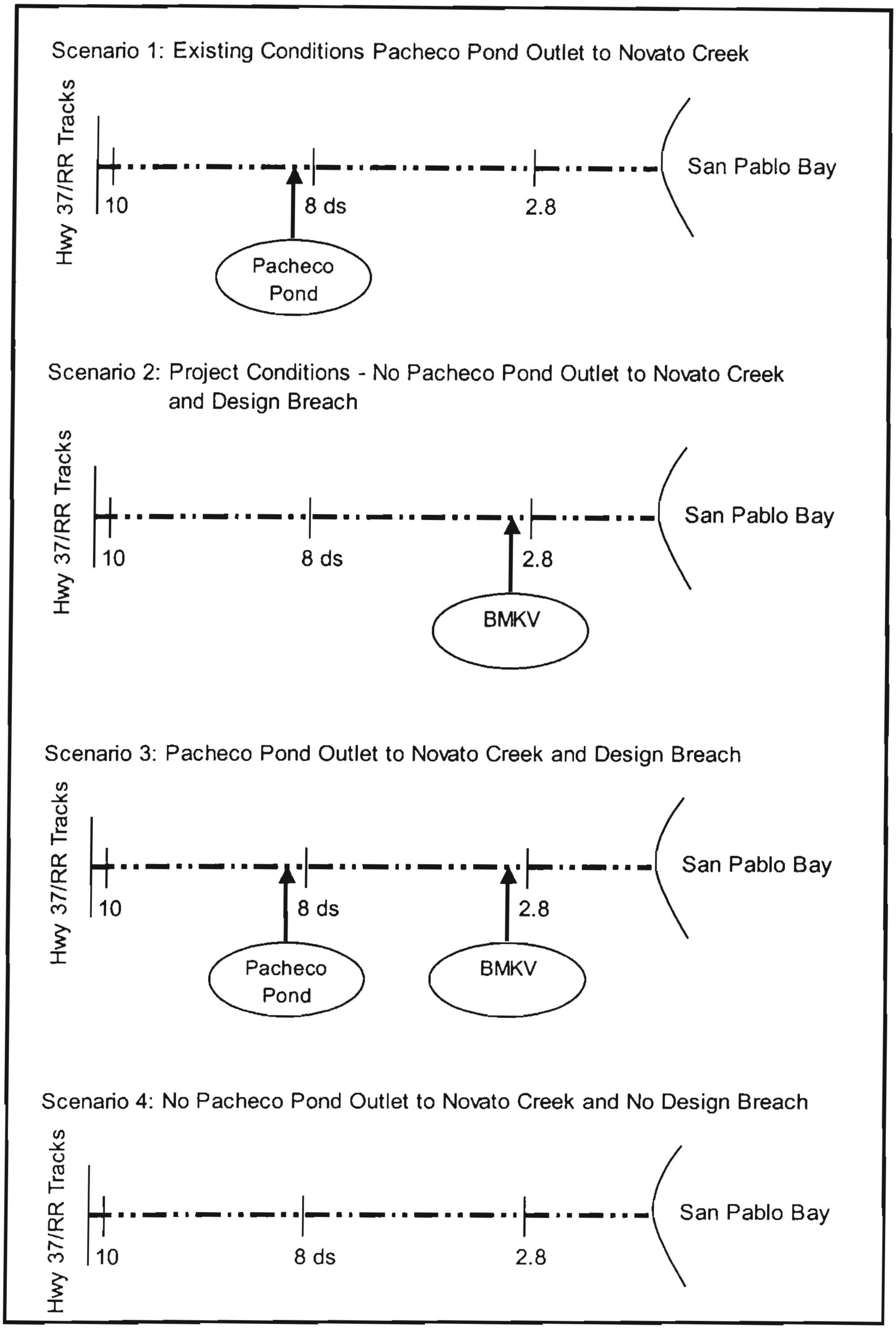


Figure 2. Geometric Scenario Schematic Diagrams

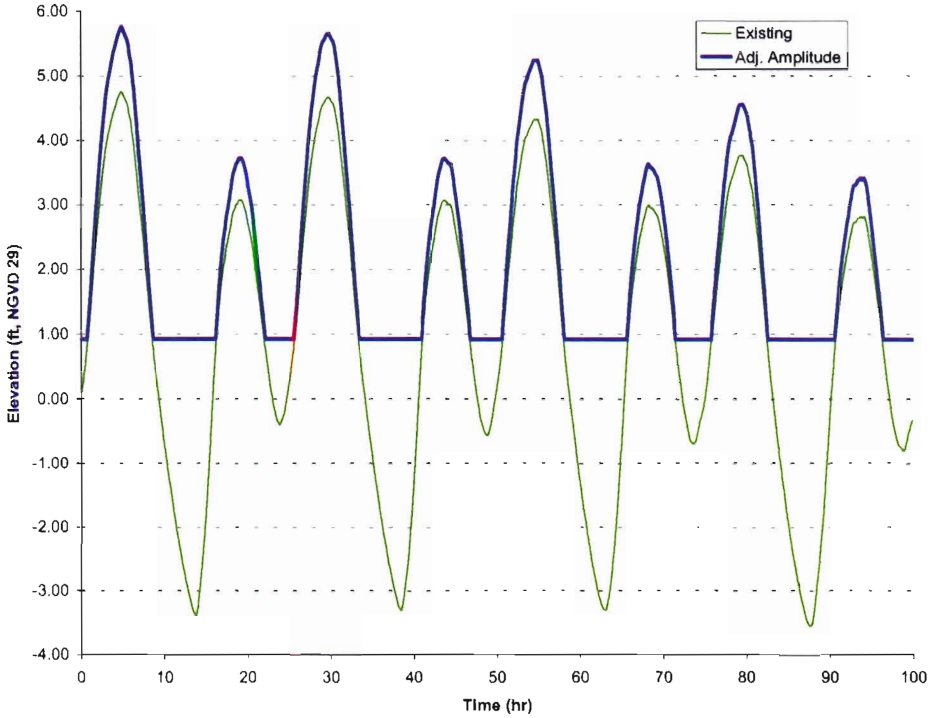


Figure 3. Tidal Boundary Condition

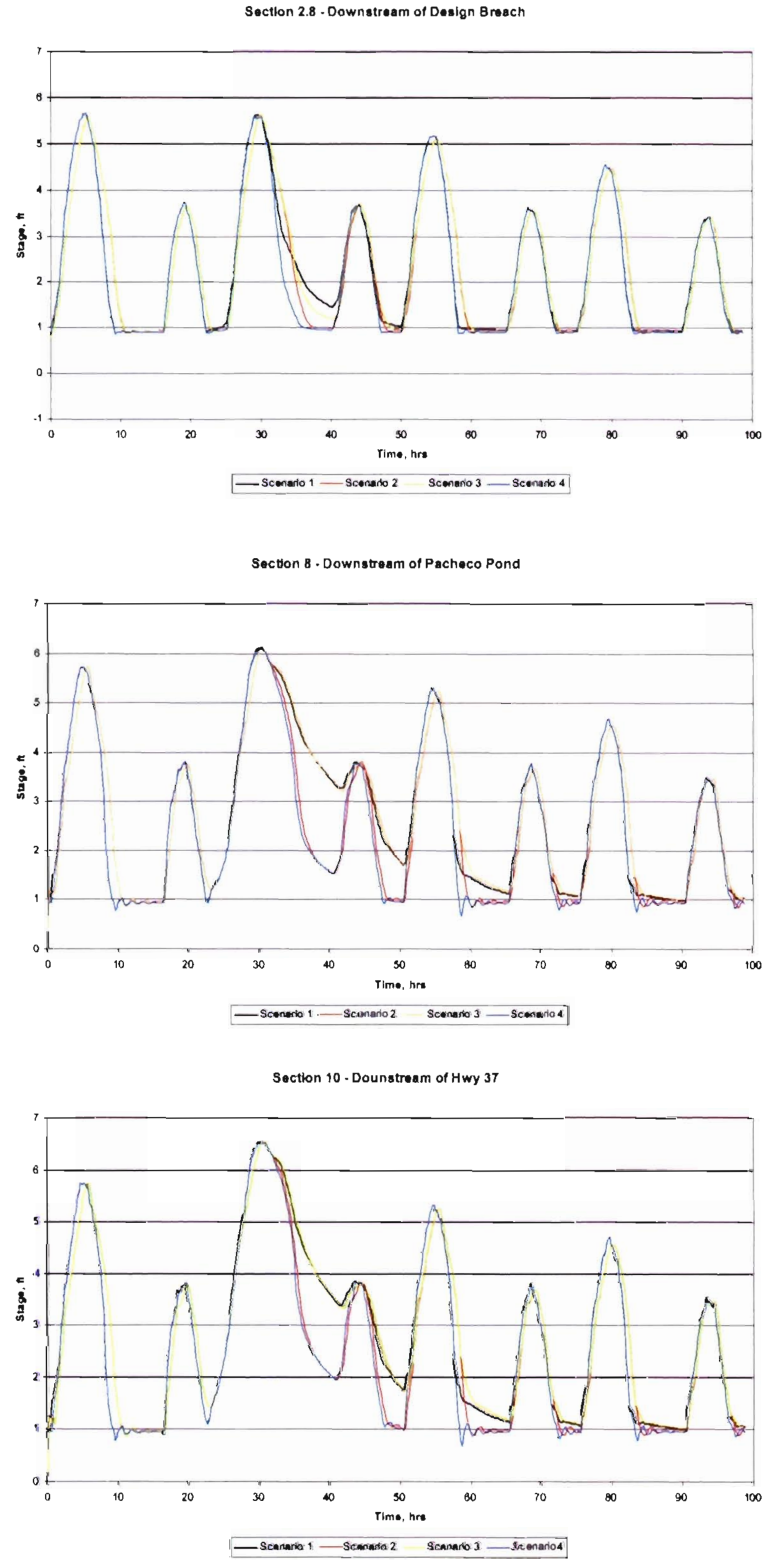


Figure 4. Stage Time Series Histories for Flow Condition A

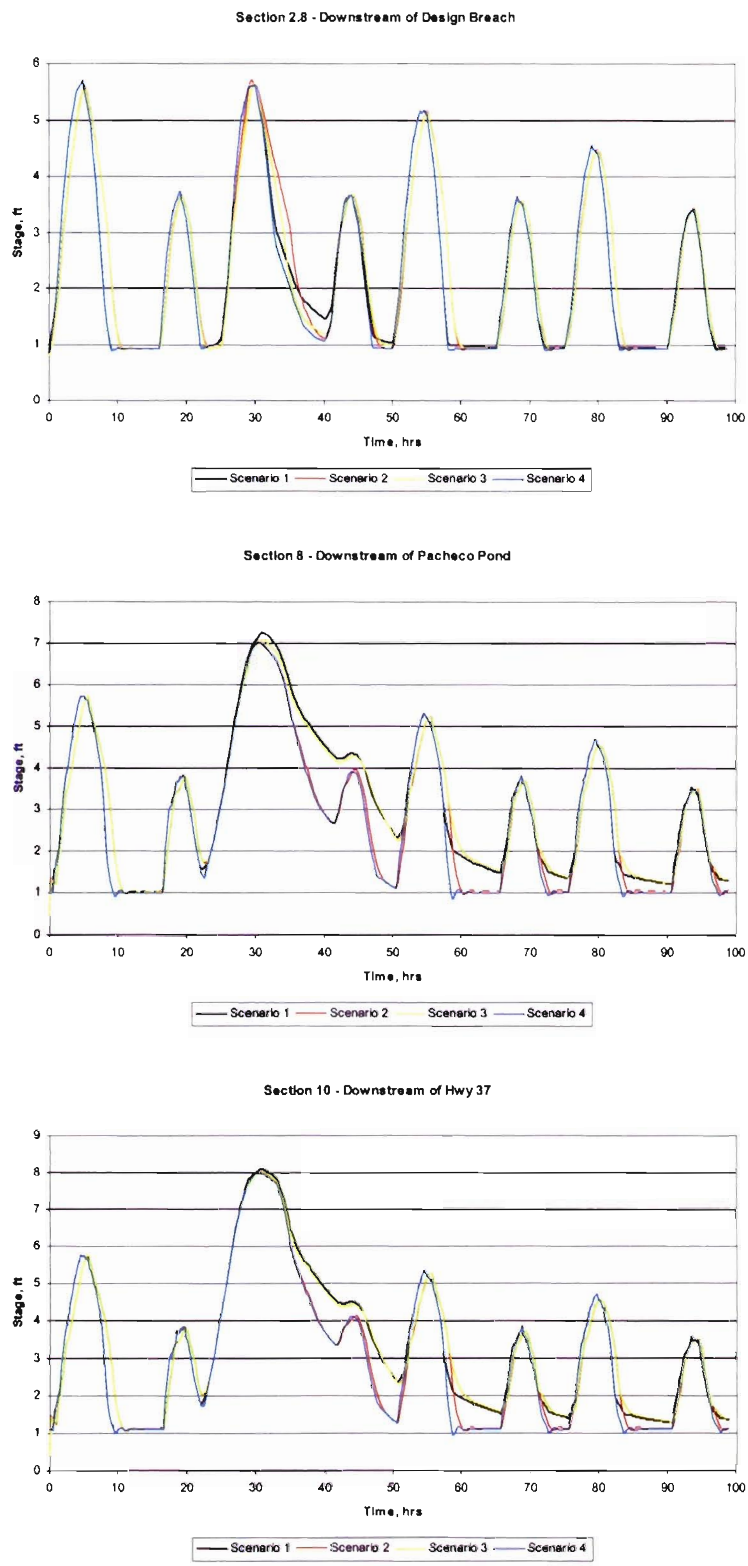


Figure 5. Stage Time Series Histories for Flow Condition B

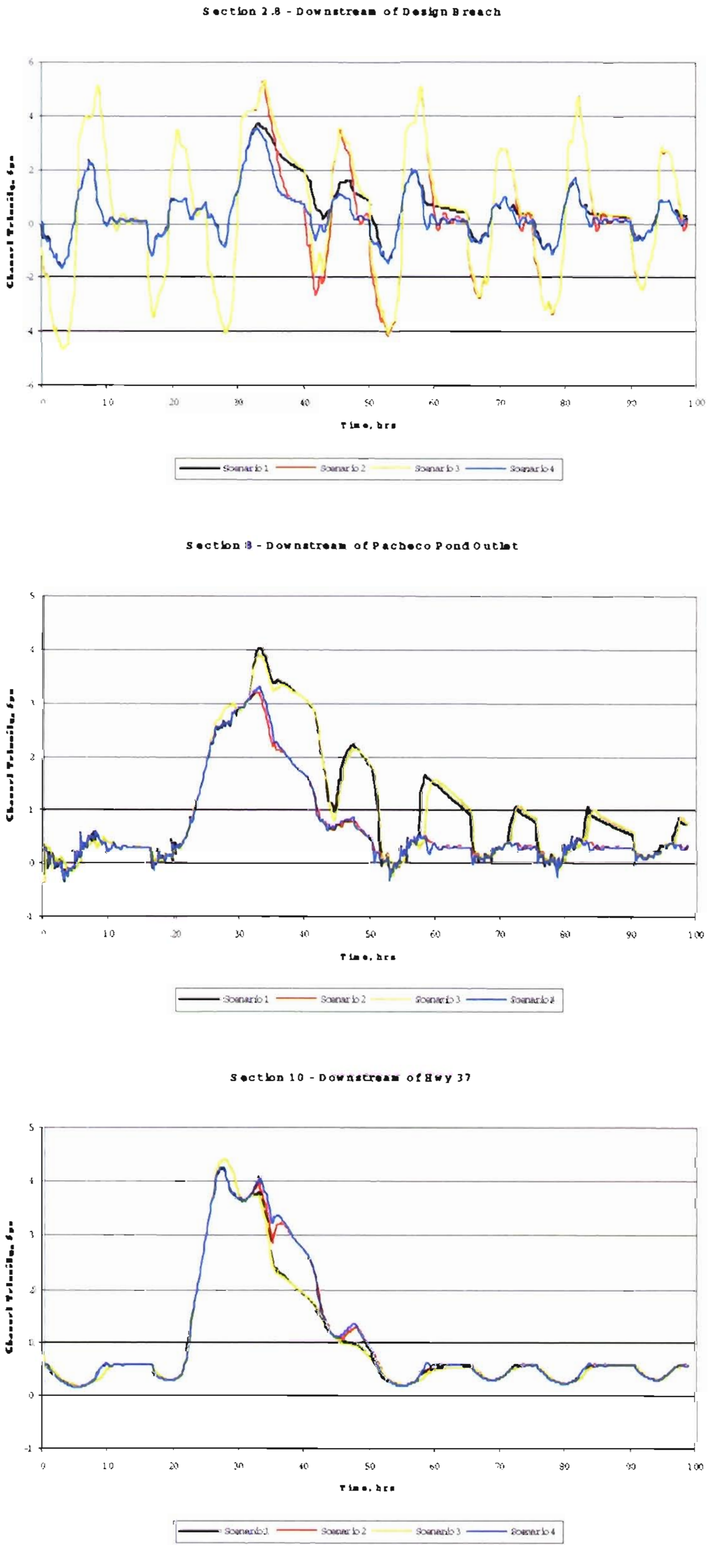
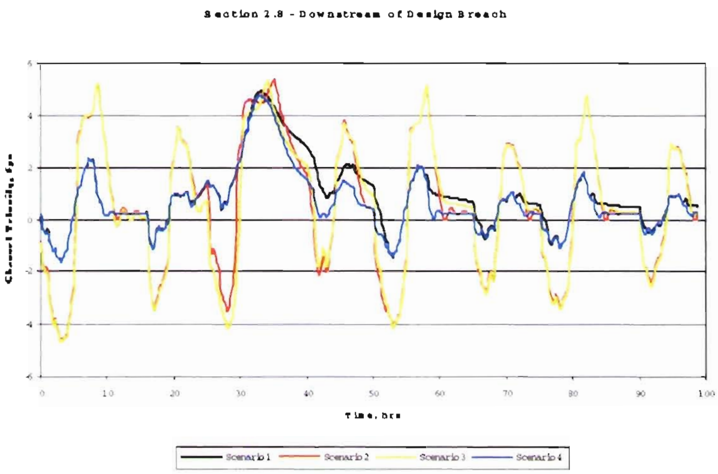
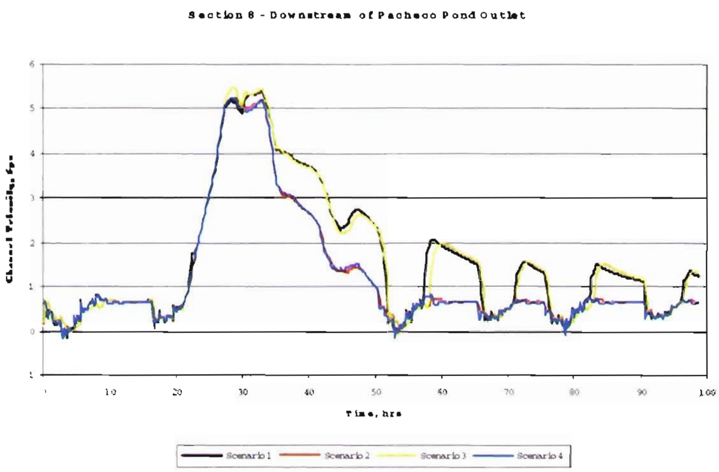


Figure 6. Velocity Time Series Histories for Flow Condition A





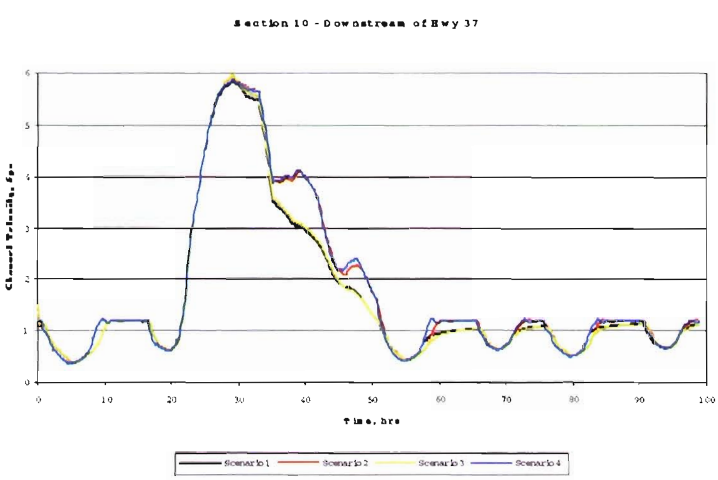


Figure 7. Velocity Time Series Histories for Flow Condition B

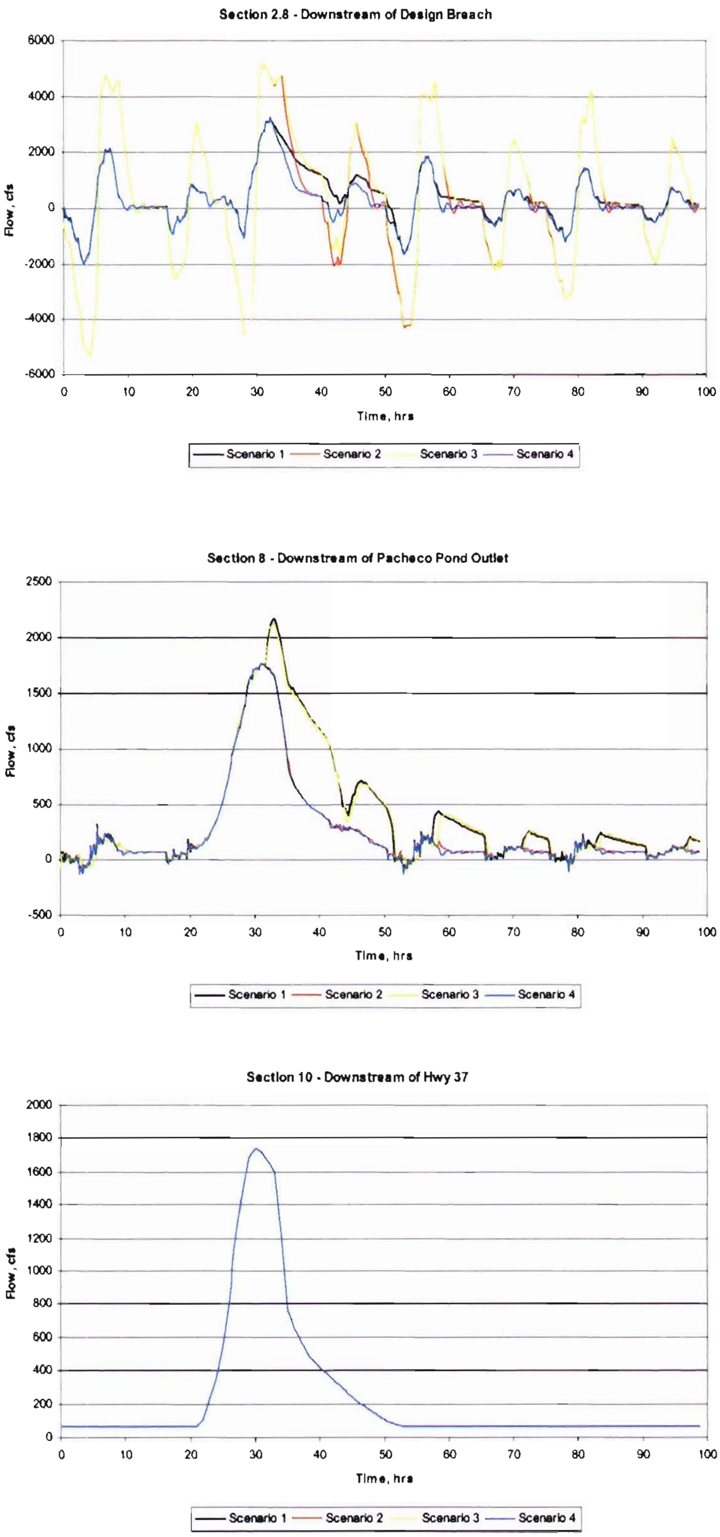


Figure 8. Hydrographs for Flow Condition A

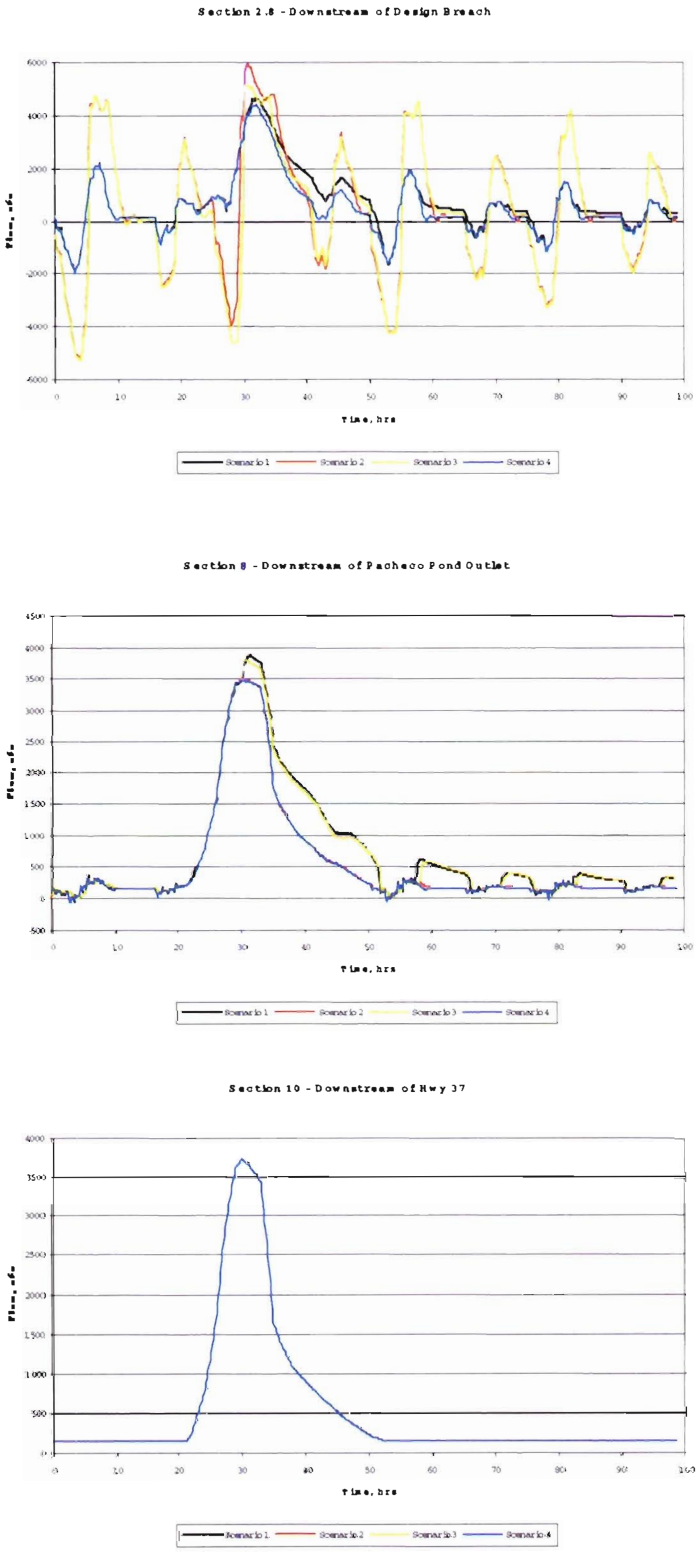


Figure 9. Hydrographs for Flow Condition B

Memorandum

northwest hydraulic consultants
3950 industrial boulevard, suite 100c
west sacramento, ca 95691
(916) 371-7400
(916) 371-7475 (fax)

Date:	October 14, 2002	Project: 50283
To:	Rich Walter	
Company/Agency:	Jones & Stokes	
From:	Brad Hall	
Subject:	Bel Marin Keys EIR Background Study	

Novato Creek Geomorphic and Hydraulic Modeling

The Bel Marin Keys (BMK) conceptual design plans call for a breach in the Novato Creek containment levee to provide tidal exchange to a proposed marsh basin near the mouth of the creek. The addition of 400 to 600 acres of tidal marsh to the existing system would enlarge the tidal prism of the creek and increase the tidal discharge in the channel reach between the breach and San Pablo Bay. To better understand the effects of the proposed breach, an unsteady hydraulic model of Novato Creek was developed and tested. Also, an empirical investigation of the surrounding tidal mudflat channel and shoals at the mouth of the creek was implemented. This memorandum discusses the background, methodology, and general results of these investigations.

Novato Creek Modeling Approach

UNET, a one-dimensional hydraulic model developed by the U.S. Army Corps of Engineers, was used to determine channel velocities in Novato Creek from tidal exchange. The marsh basin was specified as a storage area connected to the creek by the levee breach. The time series tide data used for the analysis were measured by ADEC and obtained at the mouth of the Petaluma River. Measurements were taken at 10-minute intervals over a full month period during the summer of 2000. The data was adjusted slightly so that mean sea level of the data correlated with the observed mean sea level of San Pablo Bay at the mouth of the Petaluma River (0.62 feet NGVD). No adjustments were made to the data to account for frequency or lag effects.

Cross sections for Novato Creek were developed from an algorithm that related slough channel top width to channel side slope and base width. This relationship was created by Northwest Hydraulic Consultants using data from various sloughs and channels located in the San Francisco Bay area, including Novato Creek. The equations relating the hydraulic parameters were of the form:

$$m = m_1 T^{m_2} \tag{1}$$

$$b = b_1 T \tag{2}$$

where *m* and *b* are the typical channel side slope and base width, respectively, associated with a top width *T*. The constants m_1, m_2, and b_1 were determined to be 0.13, 0.67, and 0.5, respectively, such that the hydraulic characteristics of the predicted and observed cross sections were as similar as possible. Equations 1 and 2 were then used to estimate the existing and likely future geometries of Novato Creek during the hydraulic and geomorphic modeling processes. Top widths on Novato Creek and other tidal sloughs adjacent to San Pablo Bay were measured from infrared aerial photographs taken by Air Flight Services in September of 2000.

The modeling procedure for estimating the widening of Novato Creek was an iterative process. Using the 30-day tide data and UNET, channel velocities and water surface profiles were calculated in the creek. This information was used to estimate shear stresses that developed along the channel boundary at each time step. Each value of computed shear stress, in turn, was used to estimate the incremental erosion that would take place along the channel according to the empirical equation:

$$E = M \frac{\tau - \tau_{cr}}{\tau_{cr}} \tag{3}$$

where *E* is the erosion rate, τ is the average boundary shear stress at a cross section, τ_{cr} is the critical shear stress for erosion, and *M* is an erosion coefficient.

A wide range of values is presented in the literature for the erosion coefficient. The values ranged from a low of 0.003 g/m^{2}sec found by Mehta et al. (1994) to a high of 5.0 g/m^{2}sec calculated by Ariathruai and Arulanandan (1978). In an effort to establish a suitable value for *M*, erosion data were obtained from slough channels between the years of 1994 to 1998 at Sonoma Baylands (Phillip Williams and Associates, 1999) and 1997 to 1999 at the Oro Loma Marsh (Lenington, 2001). From analysis of the data, an erosion constant of *M* = 0.015 g/m^{2}sec was established, which produced erosion rates of about 0.5 to 3 feet per year in channels with peak velocities between 3.5 and 6 feet per second.

Critical shear stress is a function of many variables including the physical and chemical properties of the eroded soil, and density and type of vegetative cover.

A midrange value of τ_{cr}=0.75 N/m^2 was adopted as a reasonable compromise. This value also produced modeling results that agreed well with the stable channel threshold velocity range of 2.5 to 3 feet per second.

Channel roughness in UNET is modeled using the Manning Equation and an associated Manning's 'n' coefficient. The coefficient accounts for hydraulic energy losses due to friction, which are responsible for the phenomenon of tidal muting. An appropriate value for Manning's n was developed using both published values and an empirical calibration of the Skaggs Island UNET model. Weisman et al. (1989) calculated coefficient values that ranged between 0.0125 and 0.0202. Chow (1959) listed values of 0.020 to 0.025 for channels made of fine silts and clays. Barnes (1967) suggested a value of n=0.026 for the Indian Fork River, which has a clay channel and a flat slope. Leopold et al. (1993) found somewhat higher roughness values for local tidal channels that ranged between 0.028 and 0.063.

For this study, Manning's n was determined by trial and error using tide data collected by ADEC (2000) and Warner and Schoellhamer (1999). Both data sets include tide data collected at the lower end of Sonoma Creek and at Hudeman Slough at the northern end of Skaggs Island. The data indicate that full tidal exchange occurs at both stations, with a lag time of about 30 to 40 minutes. With this in mind, a UNET model of the existing slough network around Skaggs Island was developed specifically to calibrate Manning's n for the system. By trial and error, it was observed that tidal muting disappeared in the model when using a roughness coefficient of n=0.02. This value was, therefore, defined as the slough channel roughness coefficient. The marsh plains were assumed to be much rougher than the channels due to dense vegetation and variable topography. A value of n=0.04 was assigned to these areas according to Barnes (1967), Chow (1959), and engineering judgment. UNET model results were relatively insensitive to the value of the marsh plain roughness.

Mudflat Modeling Approach

To estimate the potential effects of the proposed restoration on the mudflats, or shoals, at the mouth of Novato, a study of existing mudflat channels was performed. This study consisted of using bathymetric data and newly established transects in established mudflat channels around the bay to develop a relationship between mudflat channel top width and upstream tidal prism volume.

Typical mud flat cross sections were selected where the average mud flat elevation was approximately -0.5 m, NGVD 29. Tidal prism volumes in the upstream basins were estimated using the planform area of the observed channels multiplied by the vertical range in tides (MHHW to MLLW). Figure 1 presents the relationship observed between mud flat channel width and upstream

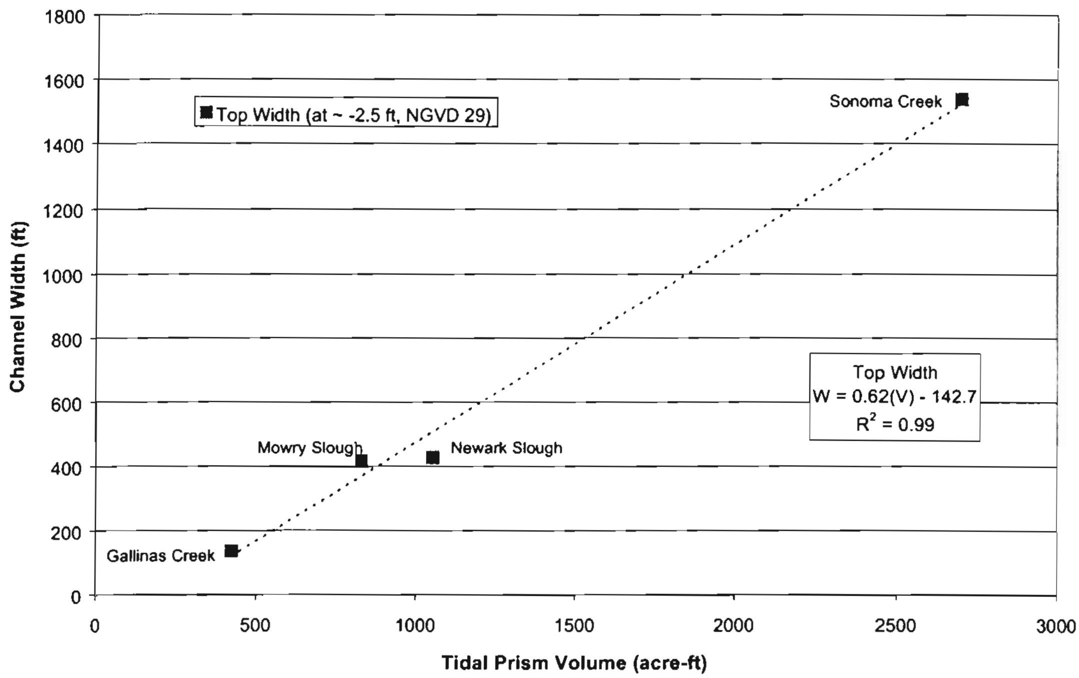


Figure 1. Mudflat channel width as a function of upstream tidal prism volume.

tidal prism volume. A best-fit line was added to the data points to correlate mud flat channel size to basin volume. Because the relationship presented in Figure 1 is linear, an increase in basin volume should result in a proportional increase in mudflat channel top width. The estimated volume of the proposed marsh basin is about 800 acre-feet at MHHW, assuming equilibrium marsh plain elevations. According to Figure 1, this corresponds to a mudflat channel width increase of between 250 to 350 feet. The total length of the mudflat channel is approximately 2000 feet.

Modeling Results and Discussion

The hydraulic and geomorphic modeling of the lower Novato Creek suggested that the 140-foot wide channel downstream of the breach would increase by 10 to 40 feet in width and about a half to one foot in depth due to the addition of the proposed marsh basin connection. This corresponds to about 2 to 5 acres of eroded marsh flood plain. The shoal analysis predicted a loss of approximately 10 to 15 acres of existing mudflat due to the basin connection, which would likely occur along the sides of the mudflat channel. The invert elevation of the mudflat channel may also decrease slightly due to the addition of the marsh basin. The marsh restoration project is expected to develop 400 to 600 acres of new tidal marsh connected to Novato Creek and over 50 acres of new fringe mud flat. Therefore, these impacts are considered to be less than significant.

The erosion of the Novato Creek channel downstream of the levee breach would occur slowly over time due to increases in flow and channel velocity. The

hydraulic model predicted a peak tidal flow increase from an existing 1500 cfs to between 3000 and 5000 cfs with the breach in place. Velocity increases will be most apparent immediately downstream of the breach where the channel width is most constricted. Existing peak tidal velocities of 2 feet per second will increase to 4 to 6 feet per second in some sections for existing Novato Creek channel configurations. This increased velocity is contained to the subtidal channel section, and leads to the predicted widening of the lowermost tidally influenced reach of Novato Creek. Because the perimeter levees are set back from the main channel near the mouth of the creek, and because the flow is forced over an elevated and highly roughened flood plain during high tides, the velocity increases near the levee due to the breach would be negligible or zero. Therefore, the increase in channel velocity would not threaten the structural integrity of the confining levees.

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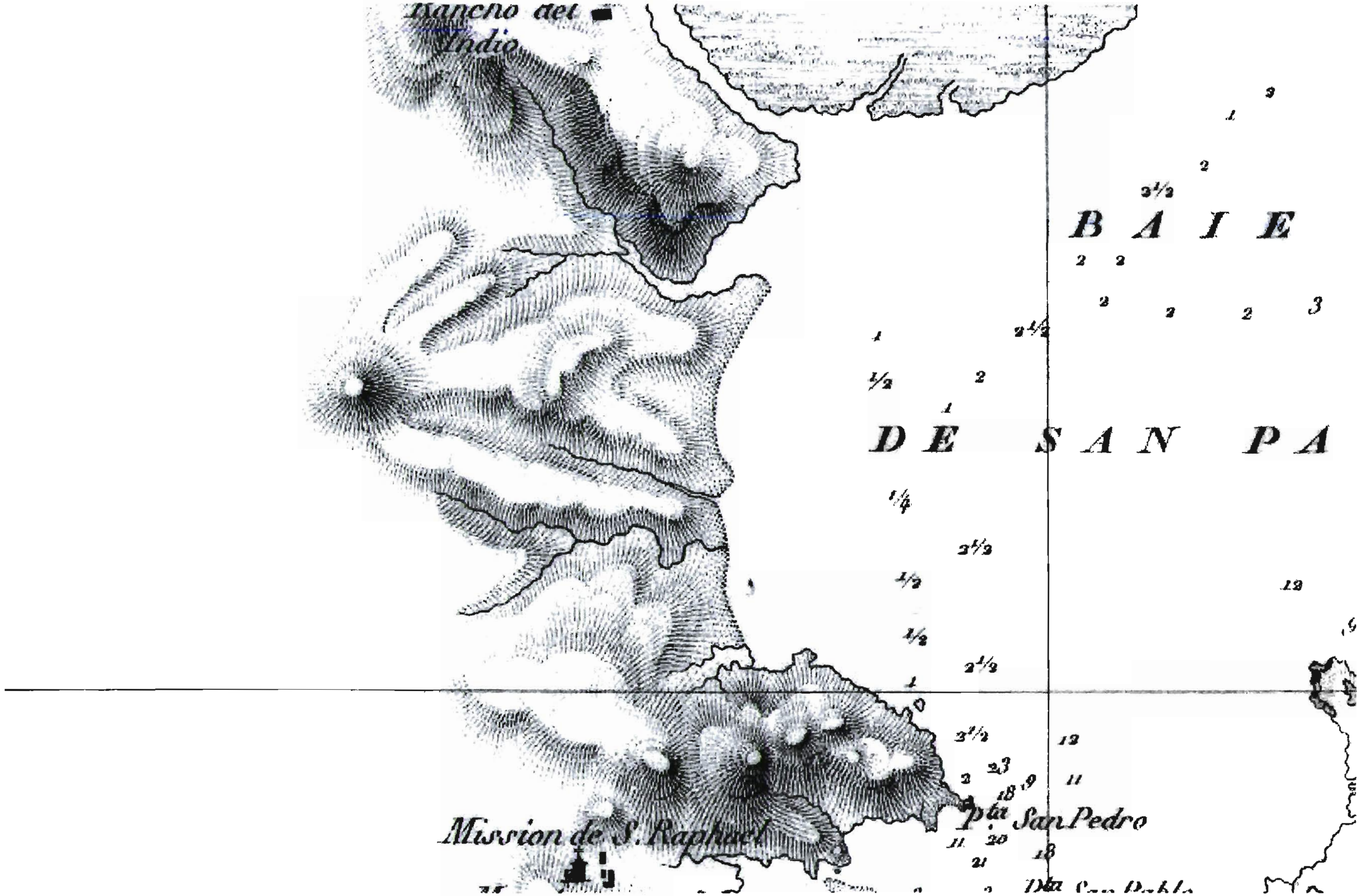
Ponding Capacity of Non-Tidal Areas, Revised Alternative 2
DRAFT - Conceptual Design Estimate
All Elevations in NGVD; Capacity in Acre-Feet

Ponding Capacity of Seasonal Wetland	**Swale**	**Seasonal Wetland in Swale**	**Upland in Swale**
Top elevation	5.00	0.00	1.50
Bottom elevation	-1.50	-1.50	0.00
Acres (90% of swale)	348	140	208
Assumed Average Bottom Elev. (50/50: top/bottom)	NA	-0.75	0.75
Ponding Capacity to 1.5'	471	315	156
Ponding Capacity to 3.5' (top of assumed 24" culvert)	1168	595	573
Possible Maximum (to 5' NGVD)	1690	805	885
Delta (per foot > 1.5')	348		
10% of swale assumed not to pond (levees, areas near BMK blvd.)			
Ponding Capacity of Expanded Pond	**Pond**	**Emergent Wetland Area**	**Total**
Acres (90% of emergent wetland)	21	11	32
Maintained surface water elevation	1.50	1.50	
Top elevation	7.00	7.00	
Ponding Capacity to 7' NGVD	116	59	175
10% of emergent wetland assumed not to pond (levee area)			
Ponding Capacity of Seasonal Wetland	**Seasonal Wetland**		
Acres (95%)	129		
Bottom Elevation	-1.50		
Invert of Overflow	1.50		
Ponding Capacity to Overflow Invert	388		
Ponding Capacity to 3.5' NGVD (top of assumed 24" culvert)	646		
Possible Maximum (to 7' NGVD)	906		
Delta (per foot>1.5' NGVD)	129		
5% of swale assumed not to pond (levee area)			
TOTALS FOR NON-TIDAL AREAS	**To Overflow Invert**	**To Top of 24" Culverts**	**Possible Maximum**
Swale	471	1168	1690
Expanded Pond	175	175	175
Seasonal Wetland	388	646	906
TOTAL	**1034**	**1989**	**2771**
Subtotal Pond and Wetland	*563*	*821*	1081

HISTORICAL MAPS RELATIVE TO PROJECT AREA

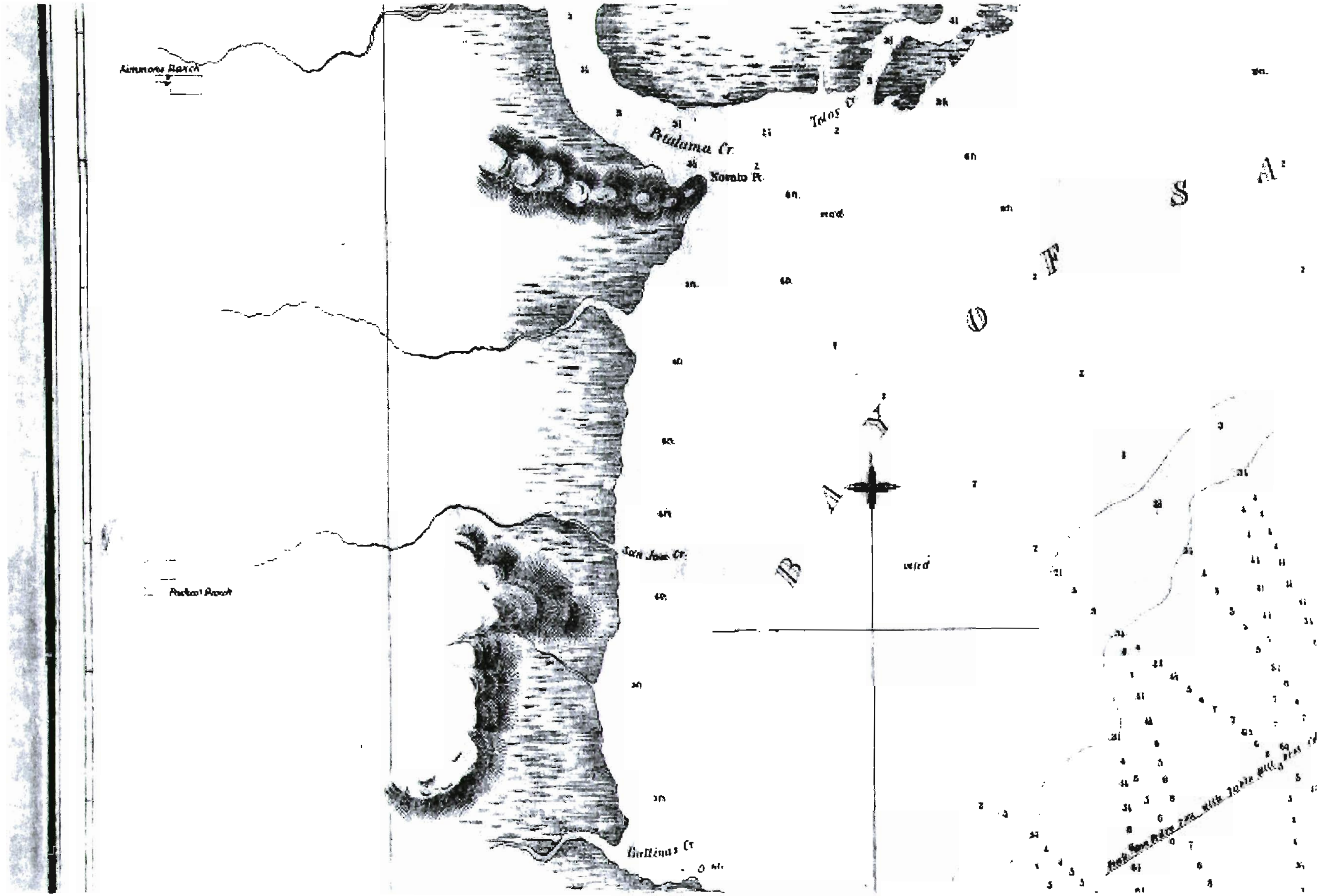
1.	1844	San Pablo Bay	(Eugene Duflot de Mofras)
2.	1852	San Pablo Bay	(Cadwalader Ringgold
3.	1854	San Pablo Bay	(U.S. Coast and Geodetic Survey)
4.	1860	Marin County	(A. Van Dorn)
5.	1874	San Pablo Bay	(Cal. Board of State Harbor Commissioners)
6.	1887	San Pablo Bay	(U.S. Coast and Geodetic Survey)
7.	1897	San Pablo Bay	(U.S. Coast and Geodetic Survey)
8.	1914	Petaluma – 15 min.	(U.S. Geological Survey)
9.	1916	Mare Island – 15 min.	(U.S. Geological Survey)
10.	1942	Petaluma – 15 min.	(U.S. Geological Survey)
11.	1951	Petaluma Point – 7.5 min.	(U.S. Geological Survey)
12.	1954	Novato – 7.5 min.	(U.S. Geological Survey)

PORTION OF 1844 MAP OF SAN PABLO BAY (EUGENE DUFLOT DE MOFRAS)



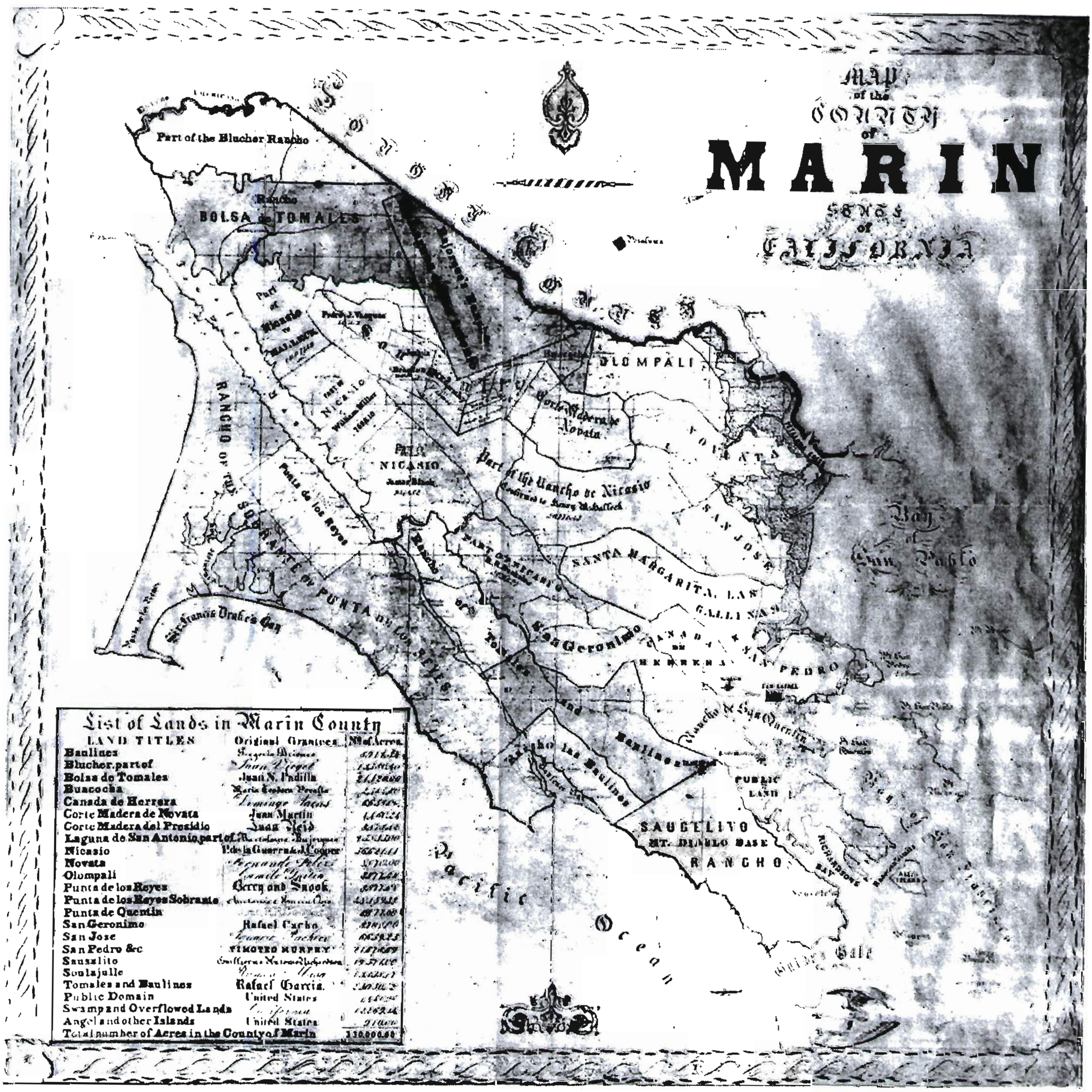
Ref: Port De San Francisco Dans La Haute Californie. No. 16. (with) Entree Du Port De San Francisco et des mouillages del Sausalito et de la Yerba Buena. Publie Par Arthus Bertrand. Grave par S. Jacobs. Voyage de Mr. Duflot de Mofras. 1844.

PORTION OF 1852 MAP OF SAN PABLO BAY FROM CADWALADER RINGGOLD



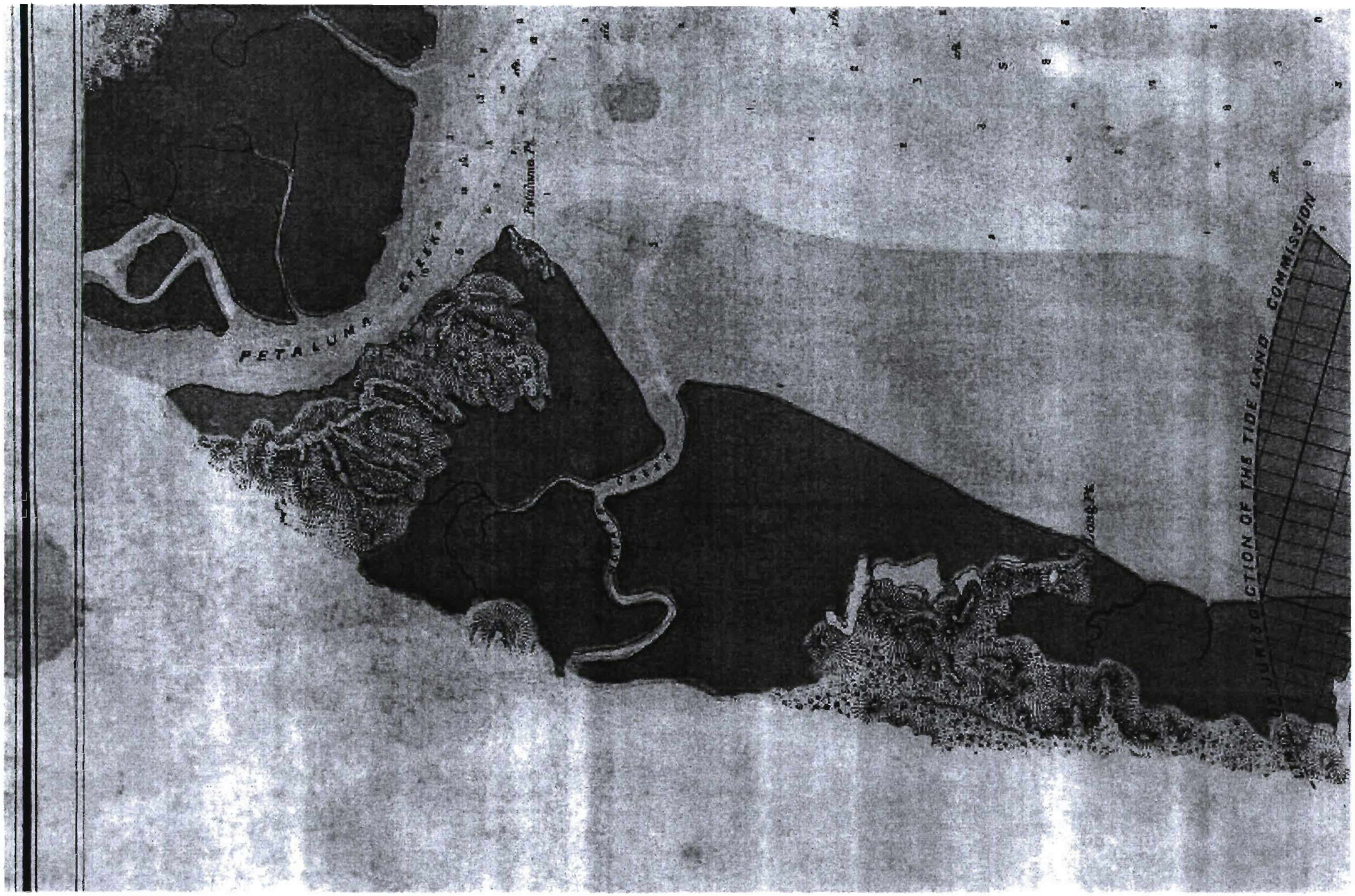
Reference: Chart of the Bay of San Pablo Straits Of Carquines and part of the Bay of San Francisco California By Cadwalader Ringgold Commander, U.S. Navy. Assisted by Simon F. Blunt, Lieut. U.S.N. 1850. Projected, Constructed & Drawn by Fred. D. Stuart, Hydrographer, late of the U.S. Ex.Ex. Assisted by A.H. Campbell, Civil Engineer. Entered ... 1851, by Cadwalader Ringgold ... District of Columbia. C.B. Graham, Lithr. Washington, D.C.

1860 MAP OF MARIN COUNTY



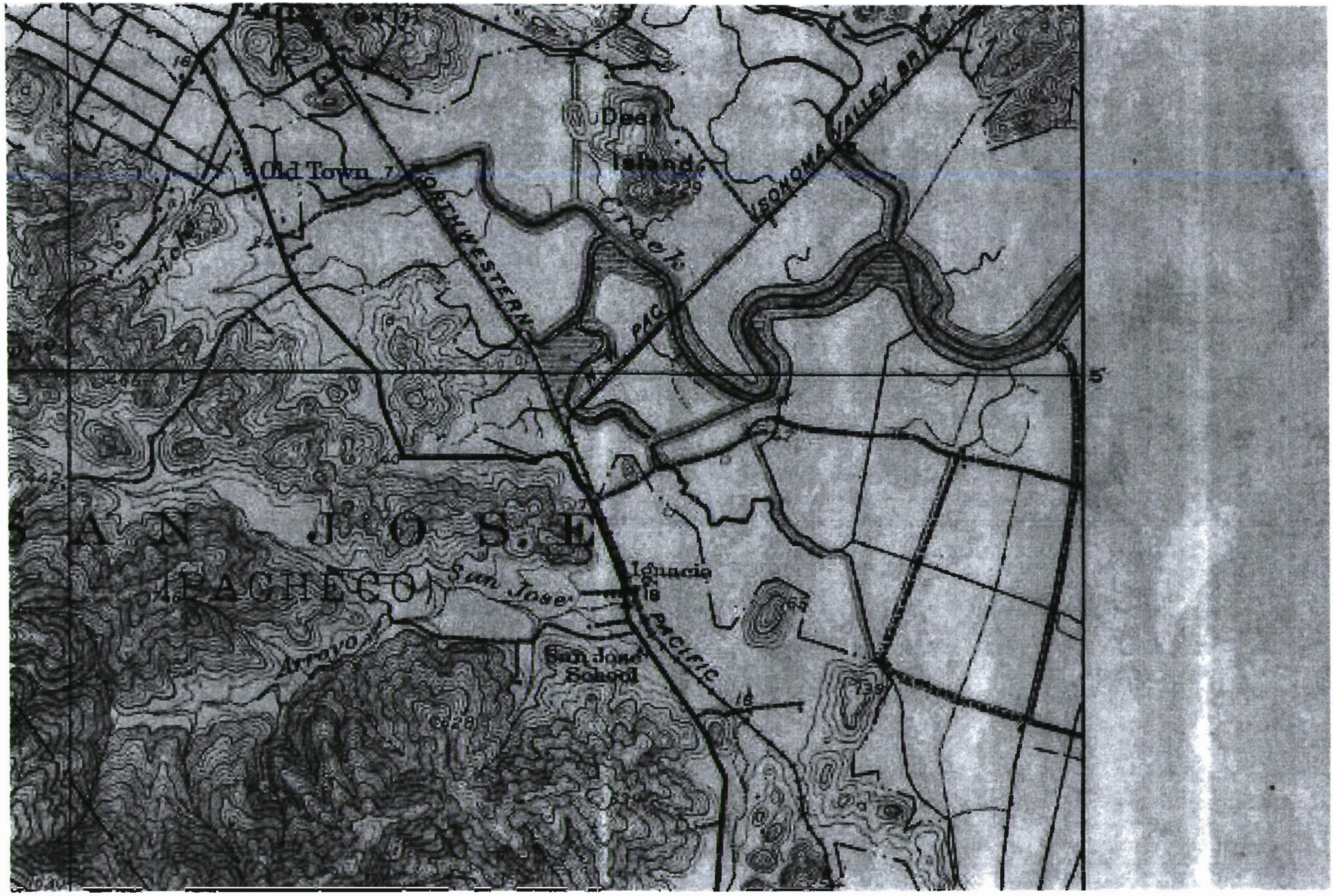
REFERENCE: Van Dorn, A. 1860. Map of Marin County (reviewed at U.C. Berkeley Bancroft Library). Berkeley, CA. Also at: http://library.berkeley.edu/EART/maps/marin.jpg

PORTION OF 1874 CALIFORNIA BOARD OF STATE HARBOR COMMISSIONERS
MAP OF SAN PABLO BAY



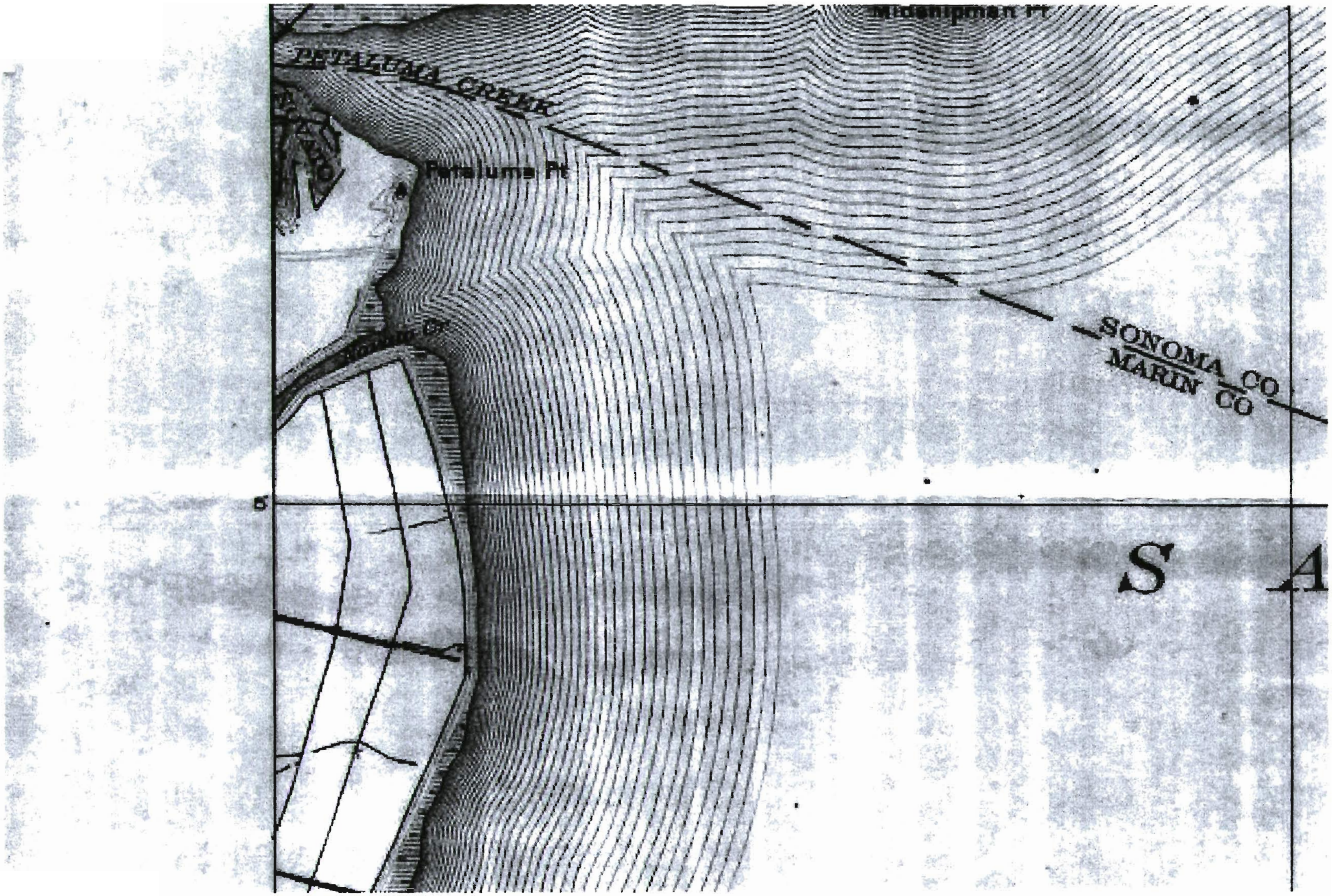
REFERENCE: Map exhibiting the salt marsh, tide and submerged lands disposed of by the State of California in and adjacent to the bays of San Francisco and San Pablo and now subject to reclamation. Prepared from maps of the U.S. Coast Survey & official records by order of the Board of State Harbor Commissioners for the United States Commissioners on San Francisco Harbor. By T.J. Arnold, engineer of the sea wall. 1874. U.S. Commissioners Rear Admiral John Rodgers, Major G.H. Mendell, Prof. George Davidson. State Harbor Commissioners Samuel Soule, T.D. Mathewson, D.C. McRuer. Britton Rey & Co. Lith. S.F.

PORTION OF 1914 U.S.G.S 15-MINUTE TOPOGRAPHIC MAP FOR PETALUMA, CALIFORNIA



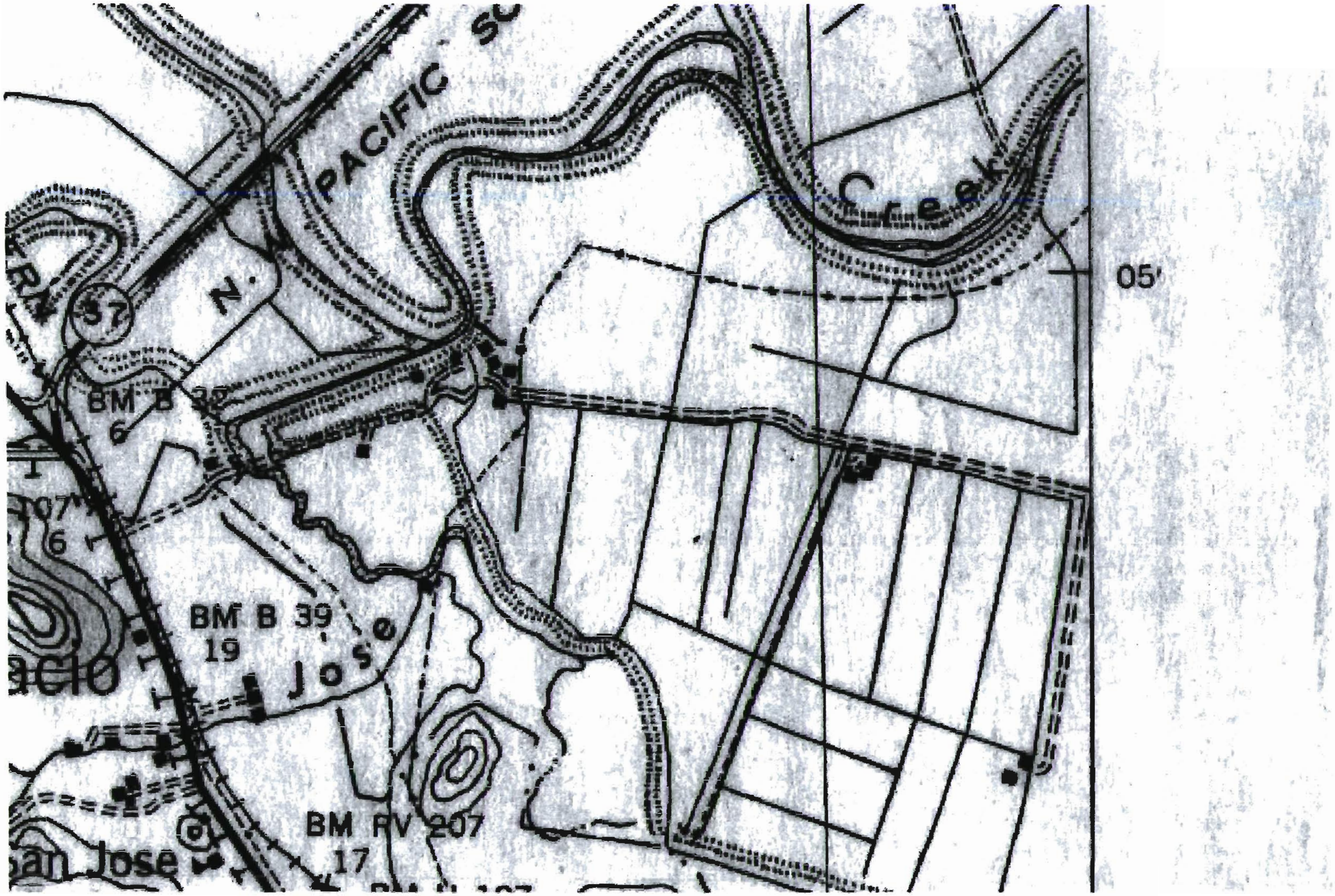
REFERENCE: U.S. Geological Survey. 1914. Reprinted 1924. California: Petaluma Quadrangle. 15-minute Topographic Series. Surveyed 1910-1912. On file, California Division of Mines and Geology Library, Sacramento.

PORTION OF 1916 USGS 15- MINUTE TOPOGRAPHIC MAP FOR MARE ISLAND, CALIFORNIA



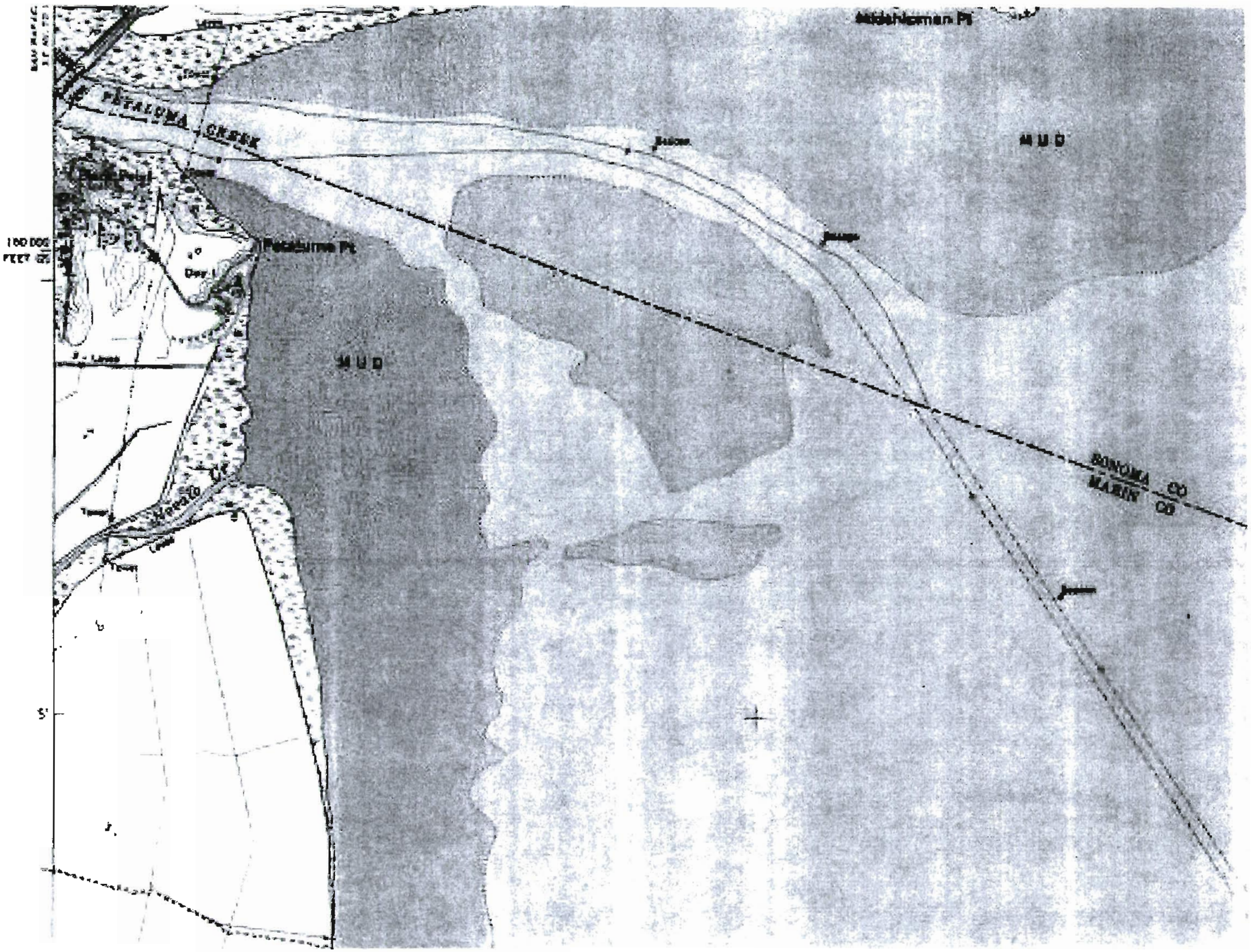
REFERENCE: U.S. Geological Survey 1916. Reprinted 1927. California: Mare Island Quadrangle. 15-minute Topographic Series. Surveyed 1913-1914. On file, California Division of Mines and Geology Library, Sacramento.

PORTION OF 1942 USGS 15-MINUTE TOPOGRAPHIC MAP FOR PETALUMA, CALIFORNIA



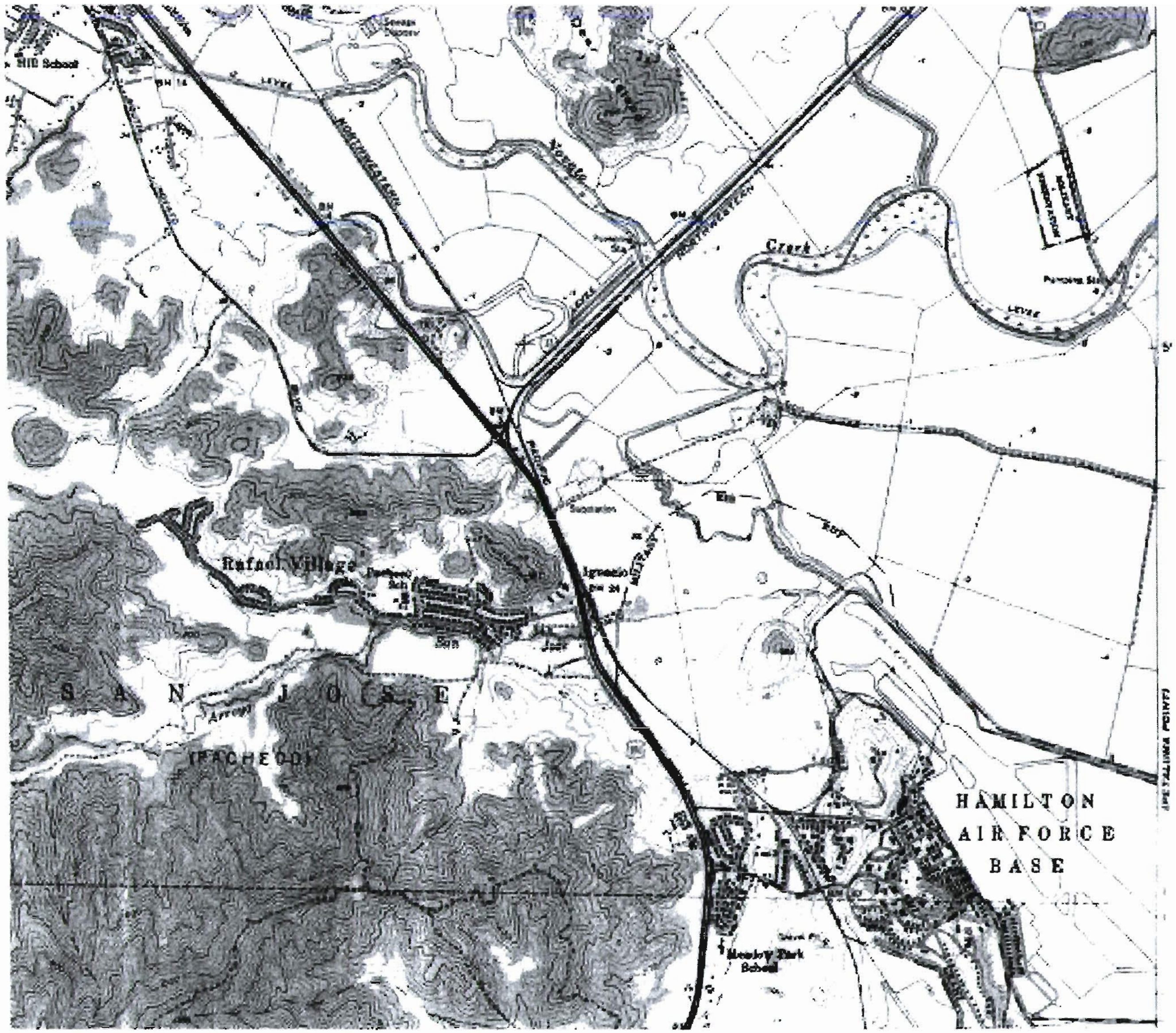
REFERENCE: U.S. Geological Survey. 1942. California: Petaluma. 15-minute Topographic Series. On file, California Division of Mines and Geology Library, Sacramento.

PORTION OF 1951 USGS 7.5-MINUTE TOPOGRAPHIC MAP FOR PETALUMA POINT, CALIFORNIA



REFERENCE: U.S. Geological Survey. 1951. California: Petaluma Point Quadrangle. 7.5-minute Topographic Series. On file, California Division of Mines and Geology Library, Sacramento.

PORTION OF 1954 U.S.G.S 7.5-MINUTE TOPOGRAPHIC MAP FOR NOVATO, CALIFORNIA



REFERENCE: U.S. Geological Survey. 1954. California: Novato Quadrangle. 7.5-minute Topographic Series. On file, California Division of Mines and Geology Library, Sacramento.

Appendix C

Summary of Bel Marin Keys Flood Easements, Marin County Flood Ordinances and Supporting Information

Summary of BMKV Flood Easements
and Marin County Flood Zoning Ordinances and Zoning Code

Summarized below are the following:

Precise Limits of F-1 Floodway District for Novato Creek (Spring 1971)
Ultimate Flood Control Channel Improvement Map (Spring 1971)
Marin County Ordinance No. 2001 (Adopted May 22, 1973)
Letter and Agreement Regarding the Maintenance of Pacheco Pond (February 28, 1980, March 4, 1980)
BMK Unit V Drainage Agreement No. 1 (May 12, 1980)
BMK Unit V Drainage Agreement No. 2 (June 10, 1986)
Agreement For Dredging Spoils Disposal Site on BMK Unit V (June 10th 1986)
Agreement for Dredging Spoils Disposal Site (October 12, 1995)
Amendment to Agreement for Dredging Spoils Disposal Site (Feb. 21 1997)
Second Amendment to Agreement for Dredging Spoils Disposal Site (Dec. 9, 1998)
Easement for Emergency Spillway and for Discharging Water (Jan. 7, 1997)
Marin County Zoning Map (1996)
Marin County Code Chapter 22.94 (F-1 Zone)
Marin County Code Chapter 22.95 (F-2 Zone)

Precise Limits of F-1 Floodway District for Novato Creek (Spring 1971)

Series of 14 maps depicting the F-1 designation. F-1 designation includes the adjacent flood plain of Novato Creek. The northern portion of the levee adjacent to Novato Creek is designated F-1 including approximately 8 acres of BMKV. Limits of F-1 are shown on Figure 4-3.

Ultimate Flood Control Channel Improvement Map (Spring 1971)

Lower Novato Creek (i.e. from Highway 101 to San Pablo Bay) is separated into 4 segments. For each portion, dimensions of the ultimate channel are provided in a cross sectional illustration of Novato Creek. Proceeding downstream the ultimate channel width increases while the levee height decreases.

Novato Creek Ultimate Channel Highway 101 to San Pablo Bay					
Segment	**Location**	**Length (approx.)**	**Top Channel**	**Bottom channel**	**Other**
A-A	Just South of Highway 101	300 feet	200 feet wide +13' MSL levee	60 feet wide -6 MSL bottom	Bank slope 3:1
B-B	101 to Pacheco Pond Outlet	14,000 feet	350 feet wide +12' MSL levee	100 feet wide -6 MSL bottom	Bank slope 6:1

C-C	Pacheco Pond Outlet to near BMK lock	8,000 feet	400 feet wide +9/10.5' MSL levee	160 feet wide -8 MSL bottom	Bank slope 6:1
D-D	BMK lock to mouth	7,000 feet	400 feet wide +10' MSL levee	160 feet wide -8 MSL bottom	Bank slope 6:1

Letter and Agreement Regarding the Maintenance of Pacheco Pond (February 28, 1980, and March 4, 1980)

Flood District and Department of Fish and Game agreed to maintain Pacheco Pond for flood protection and wildlife enhancement. Department of Fish and Game requires Flood District to install facilities at Pacheco Pond capable of maintaining a water surface level of 1.5 feet M.S.L.

Marin County Ordinance No. 2001 (Adopted May 22, 1973)

Activities that would reduce the ponding capacity of parcels that are zoned as F-2 by 25% are not allowed.

BMK Unit V Drainage Agreement No. 1 (May 12, 1980)

Flood Control District permitted filling, grading, and development of a 100-acre area (Bel Marin Keys Unit IV) (referred to as Area I in agreement; southwest portion of present-day BMK residential area) provided a 300-acre area on BMKV maintained for ponding capacity. Owner of BMKV can not fill or otherwise prevent flood water ponding on 300 acres area (Area II in agreement; Area 1 on Figure 4-3). Owner can not utilize the 300-acre area and cause additional flooding to other properties in the vicinity. Provisions of agreement remain in full force until Novato Creek ultimate channel improvements or equivalent occur.

BMK Unit V Drainage Agreement No. 2 (June 10, 1986)

Allowed owner of BMKV to fill area (by placement of dredge spoil) on northeast corner of BMKV (referred to as Area I in agreement; Area 2 on Figure 4-3). Agreement required maintenance of 70.2-acre area (referred to as Area II in agreement; Area 3 on Figure 4-3) for ponding. Other areas can substitute for designated ponding area if:

- replacement ponding area has a ponding volume as great or greater than that of designated area;
- substitution ponding area won't flood other property in the area; and
- the District agrees; or if
- Owner removes all or part of fill from dredge spoil areas to another location, therefore releasing the obligation to retain 70.2 acre-area for flood water ponding; and

- Owner provides engineered plan that is satisfactory to District

Provision of agreement remains in force until Novato Creek ultimate channel improvements occur, or All government agencies have issued permits for the development of parcels adjacent to the dredge spoil area and the 70.2 acre ponding area.

Agreement for Dredging Spoils Disposal Site on BMK Unit V (June 10th 1986)

The Bel Marin Keys Community Services District may deposit spoils from Novato Creek at the dredge spoils site (Area 2 on Figure 4-3).

Agreement for Dredging Spoils Disposal Site (October 12, 1995)

California Quartet agreed to allow BMK CSD to deposit dredge spoils in dredge spoil disposal site. Replaced 1986 agreement. Appears to be same as prior site. Expiration date of June 1, 1997.

Amendment to Agreement for Dredging Spoils Disposal Site (Feb. 21, 1997)

Extended expiration date to June 21, 1998.

Second Amendment to Agreement for Dredging Spoils Disposal Site (Dec. 9, 1998)

Extended expiration date to January 1, 2001.

Easement for Construction and Maintenance of an Emergency Spillway and for Discharging Water (Jan. 7, 1997)

California Quartet granted BMK CSD the "right to construct, maintain, and repair an emergency spillway on the existing levee", the purpose of which "is to relieve high water in the lagoon surrounding units 3 and 4 of the Bel Marin Keys subdivision" and also grants "the right to discharge water" onto a 3.034 acre portion of parcel 157-172-07 from the lagoon. Water from the lagoon shall only be discharged onto the subject parcel when the lagoon and Novato Creek reach a level of 1.5 NGVD. Spillway location shown as area 4 on Figure 4-3. Easement provides for removal of easement if "other project" includes "flood control measures, such as levees of sufficient height and/or other measures, to contain the high water in the lagoons surrounding units 3 and 4 of the Bel Marin Keys Subdivision".

Marin County Flood Zoning Map (1996)

The project area, excluding the State Lands parcel, is zone as F-2. The State Lands parcel is part of the City of Novato. F-1 zone located along Novato Creek includes approximately 8 acres of BMKV property north of Novato Creek levee. Rest of site is in F-2 zone. Flood zoning is shown on Figure 4-3 for site and Figure 4-4 for lower Novato Creek watershed.

Marin County Code Chapter 22.94 (F-1 Zone)

Purpose is to insure life and property will be protected and to prevent increased flooding caused by random and uncontrolled development. F-1 applies to primary floodway zone, which is defined as waterway and adjoining floodplain

Prohibited Uses:

- No buildings or structures
- No dredging, filling or dike construction if intended to increase water level or impede flow of F-1 zone

Permitted Uses:

- Uses existing at the time of F-1 adoption will be permitted and treated as nonconforming use according to Marin County Code Chapter 22.78
- One floating boat dock allowed per parcel within the F-1 zone

Marin County Code Chapter 22.95 (F-2 Zone)

F-2 classification applies to secondary floodway zone

Restrictions:

- No buildings, leveeing, diking, filling or activity that will reduce the ponding area and capacity shall be constructed in an F-2 area, excepted in a specified encroachment area or up to a give percentage of each parcel. The specified encroachment area and percentage of ponding capacity is designated when the F-2 district has been adopted for a specific area.
- Before activities that effect the specified encroachment area or the percentage of ponding capacity are implemented, the landowner, the county, the Marin County Flood Control and Water Conservation District (District) and other appropriate public agencies must agree to the following provisions:
    - that remaining area or percentage of the parcel is subject to ponding and overflow;
    - F-1 lands included on the property will be dedicated to the county, the District, or other public agency;
    - Drainage improvements will be constructed by the landowner to enable the remaining percentage or area to serve as ponding and overflow; and

- Other requirements needed to fulfill Marin County Code 22.94 and 22.95

Full use of the entire remaining area if ultimate flood control improvements are constructed through the parcel and the ultimate flood control channel section is constructed from the said parcel downstream

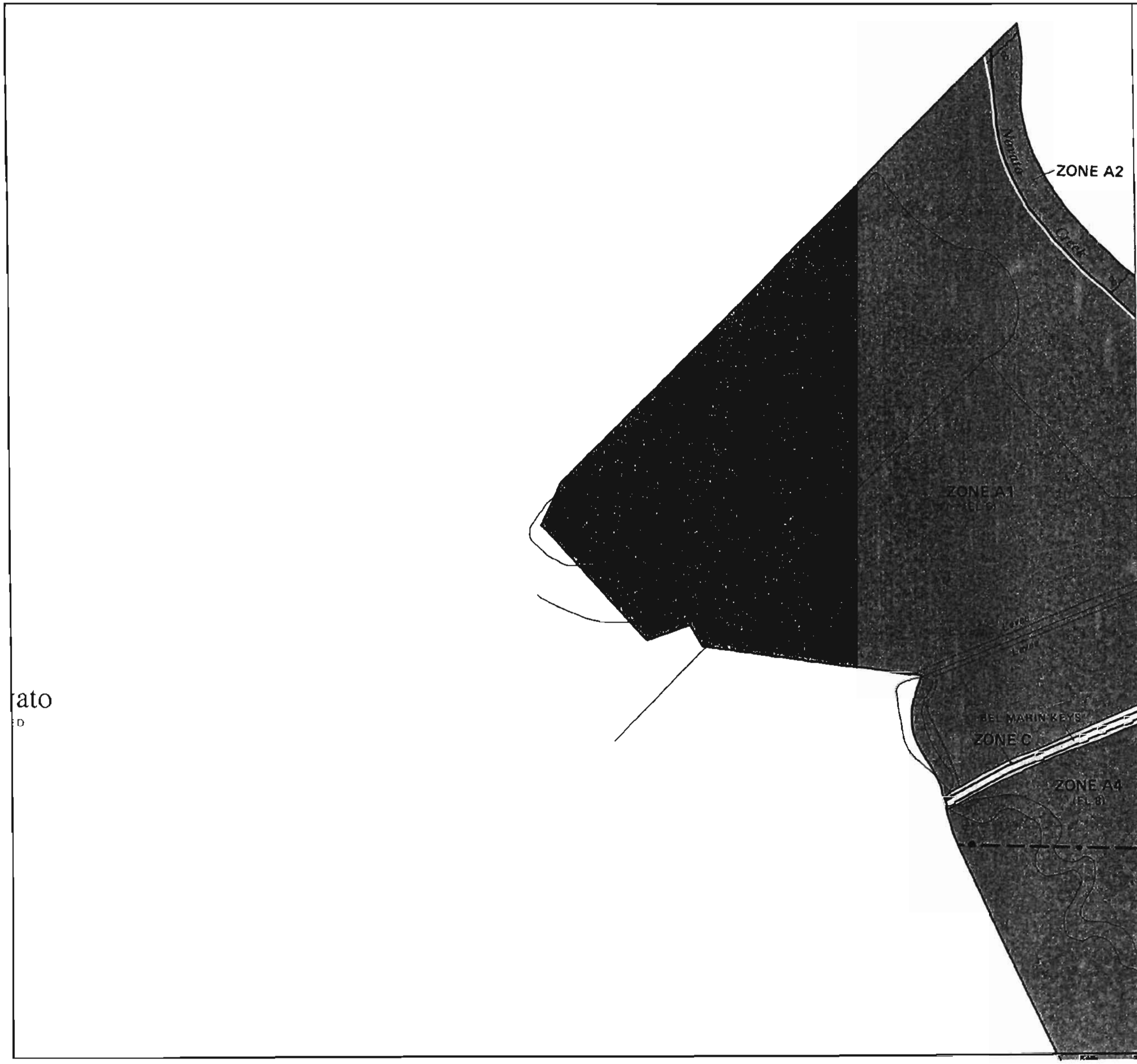
The county may permit alternative methods of flood control, which are equal to ultimate flood control channel improvements, instead of the ultimate improvements. All alternative methods are subject to the review and approval of the District or other appropriate agencies.

FEMA FLOOD INSURANCE MAPS (FIRMs)
RELATIVE TO PROJECT AREA

1. Federal Emergency Management Agency (FEMA) 1982, Flood Insurance Rate Maps (FIRM), Marin County, California, Unincorporated Areas, Community Panel 060173 0258A, Effective Date March 1, 1982.

2. Federal Emergency Management Agency (FEMA) 1982, Flood Insurance Rate Maps (FIRM), Marin County, California, Unincorporated Areas, Community Panel 060173 0259A, Effective Date March 1, 1982.

3. Federal Emergency Management Agency (FEMA) 1982, Flood Insurance Rate Maps (FIRM), Marin County, California, Unincorporated Areas, Community Panel 060173 0300A, Effective Date March 1, 1982.



APPROXIMATE SCALE

500 0 500 FEE

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARIN COUNTY, CALIFORNIA
(UNINCORPORATED AREAS)

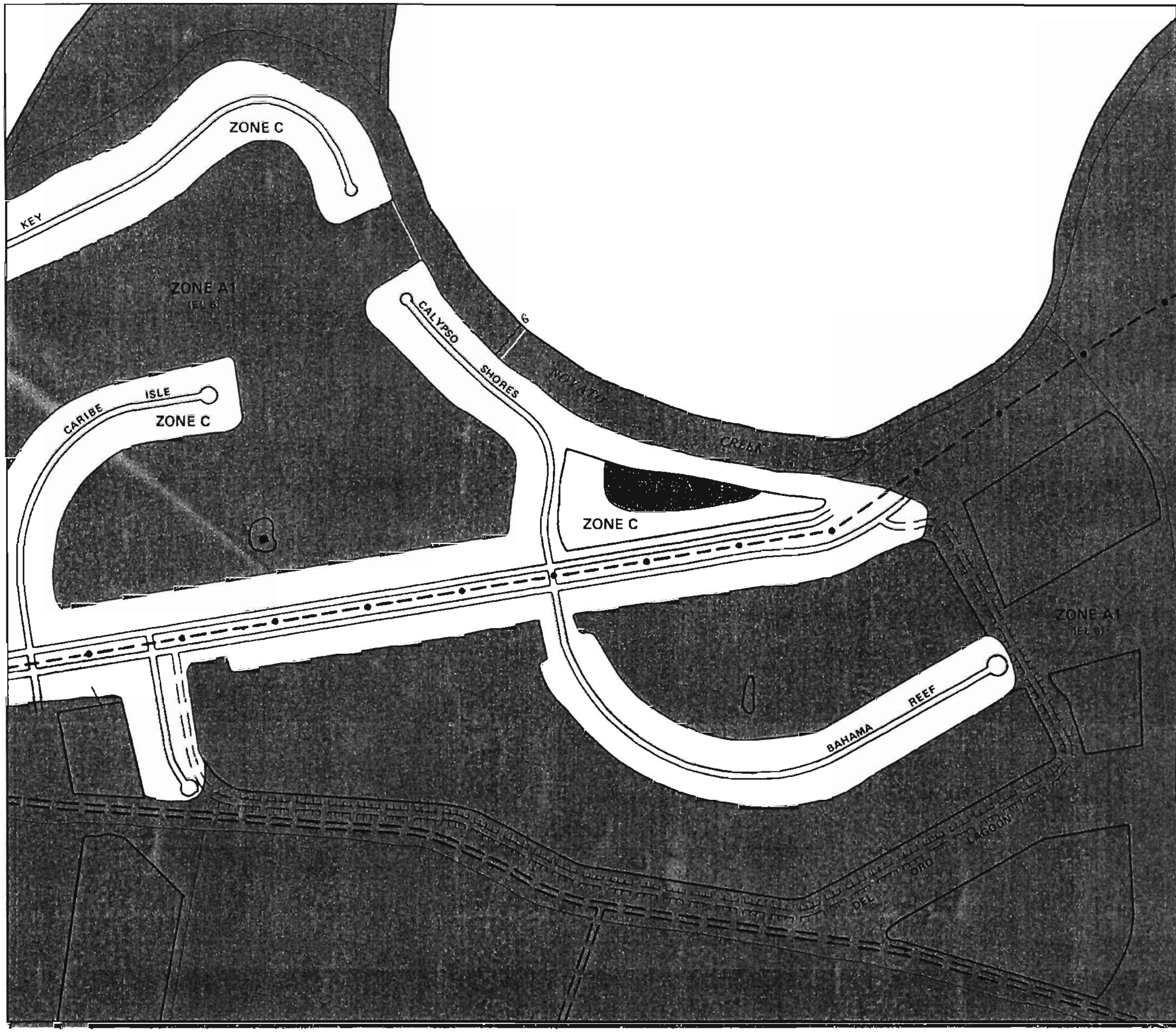
PANEL 258 OF 525
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060173 0258 A

EFFECTIVE DATE:
MARCH 1, 1982

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

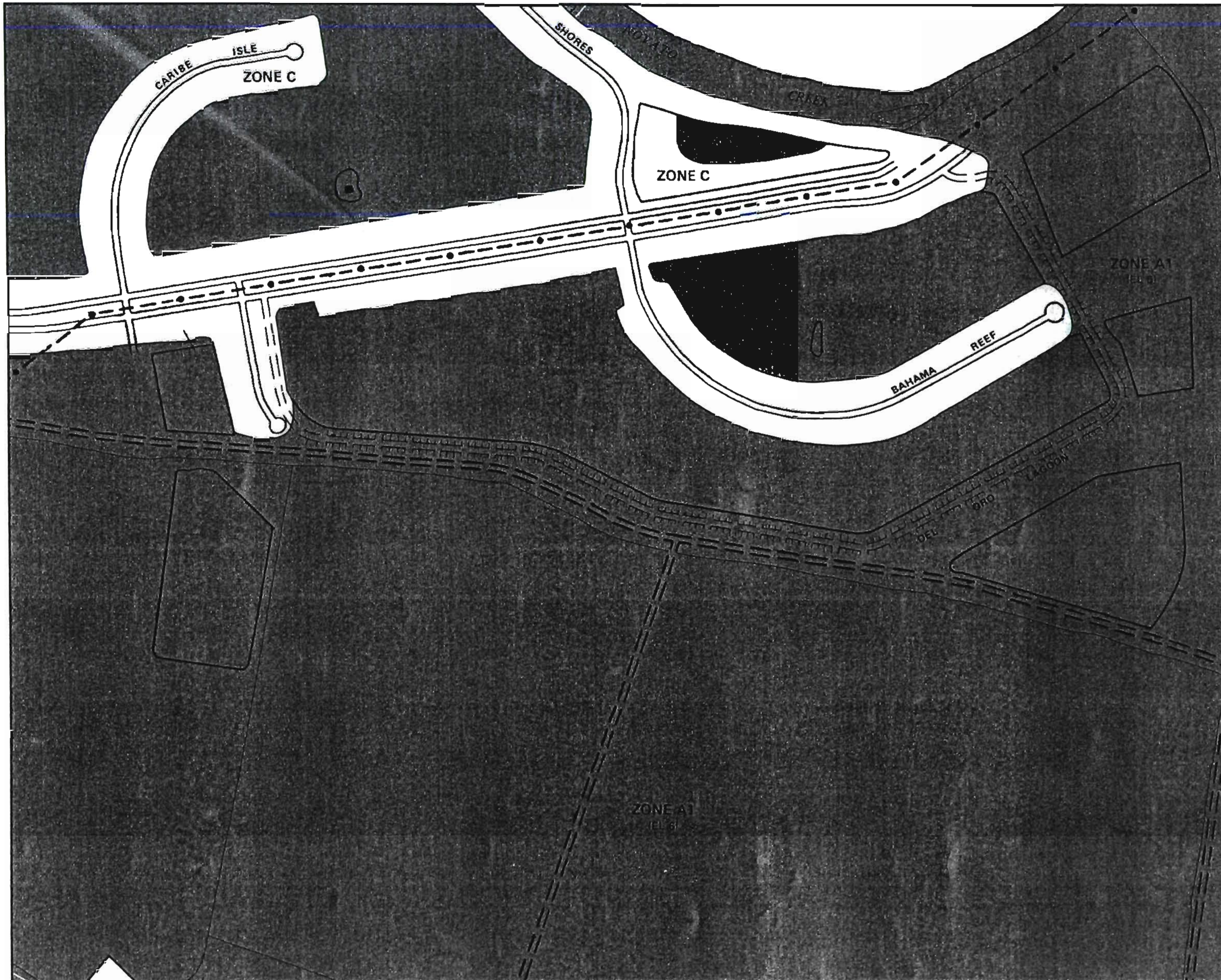
MARIN COUNTY, CALIFORNIA
(UNINCORPORATED AREAS)

PANEL 259 OF 525
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060173 0259 A

EFFECTIVE DATE:
MARCH 1, 1982

Federal Emergency Management Agency



APPROXIMATE SCALE

500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARIN COUNTY, CALIFORNIA
(UNINCORPORATED AREAS)

PANEL 259 OF 525
(SEE MAP INDEX FOR PANELS NOT PRINTED)

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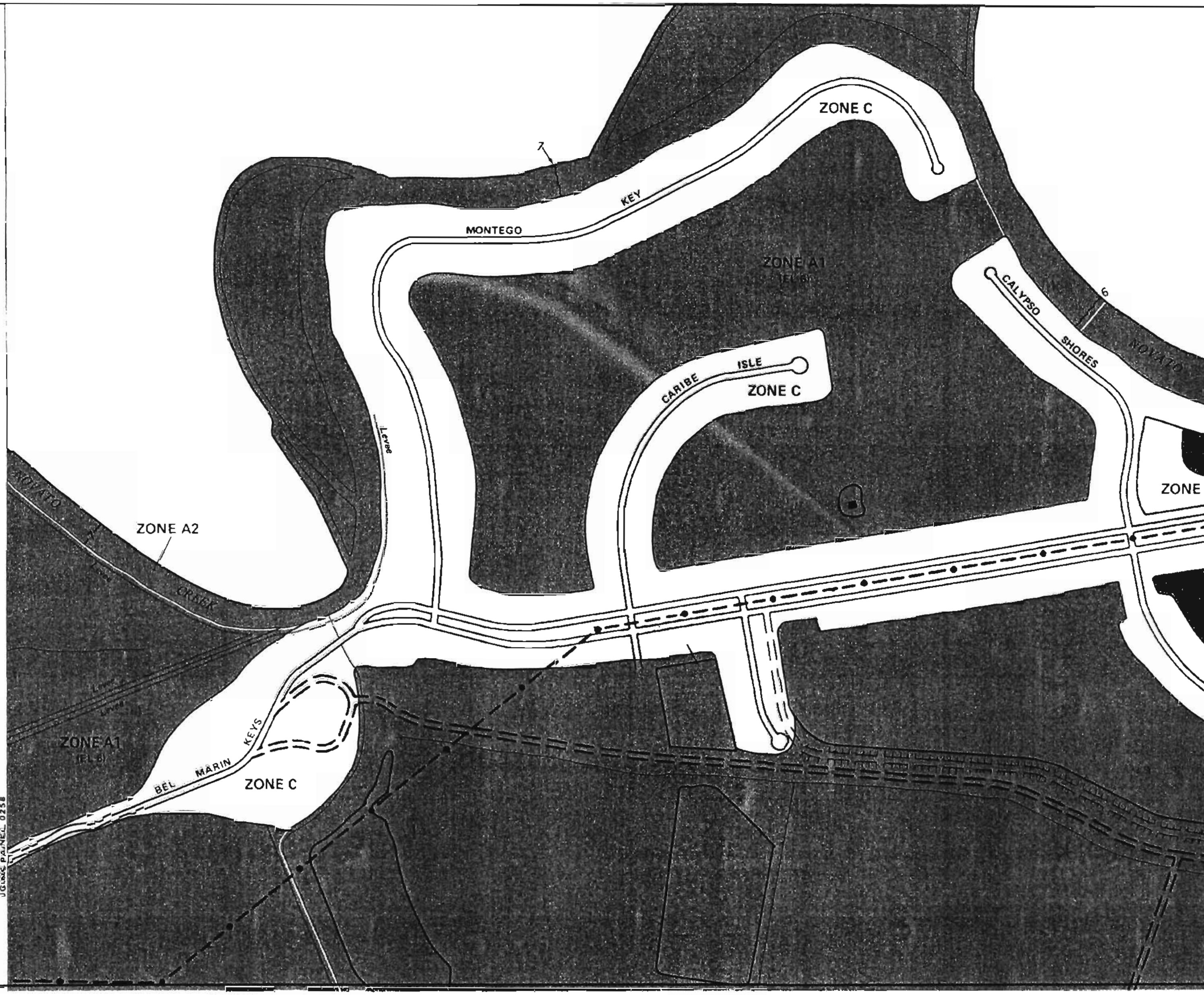
060173 0259 A

EFFECTIVE DATE:
MARCH 1, 1982

Federal Emergency Management Agency



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARIN COUNTY, CALIFORNIA
(UNINCORPORATED AREAS)

PANEL 259 OF 525
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060173 0259 A

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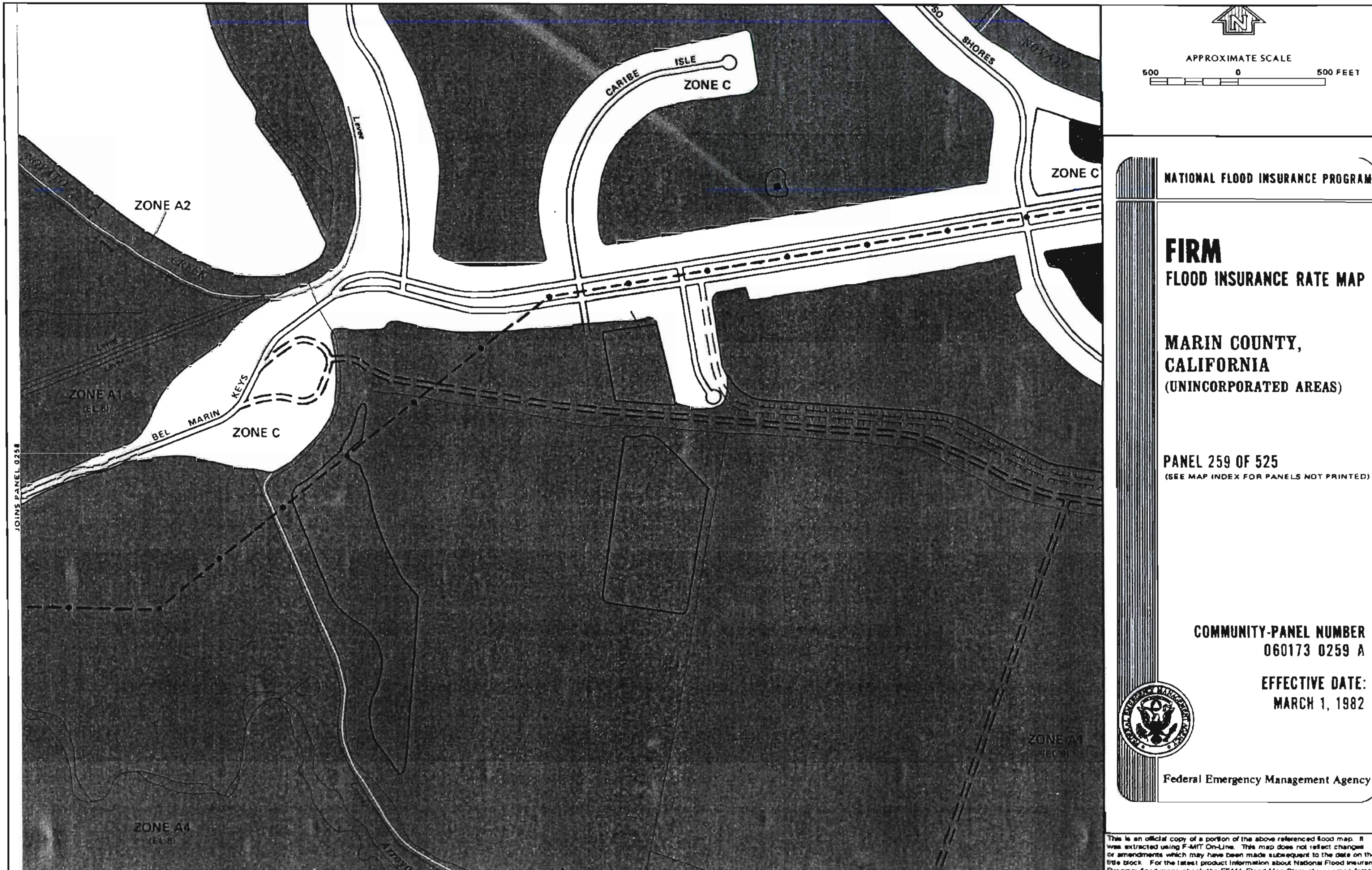
MARCH 1, 1982

Federal Emergency Management Agency



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

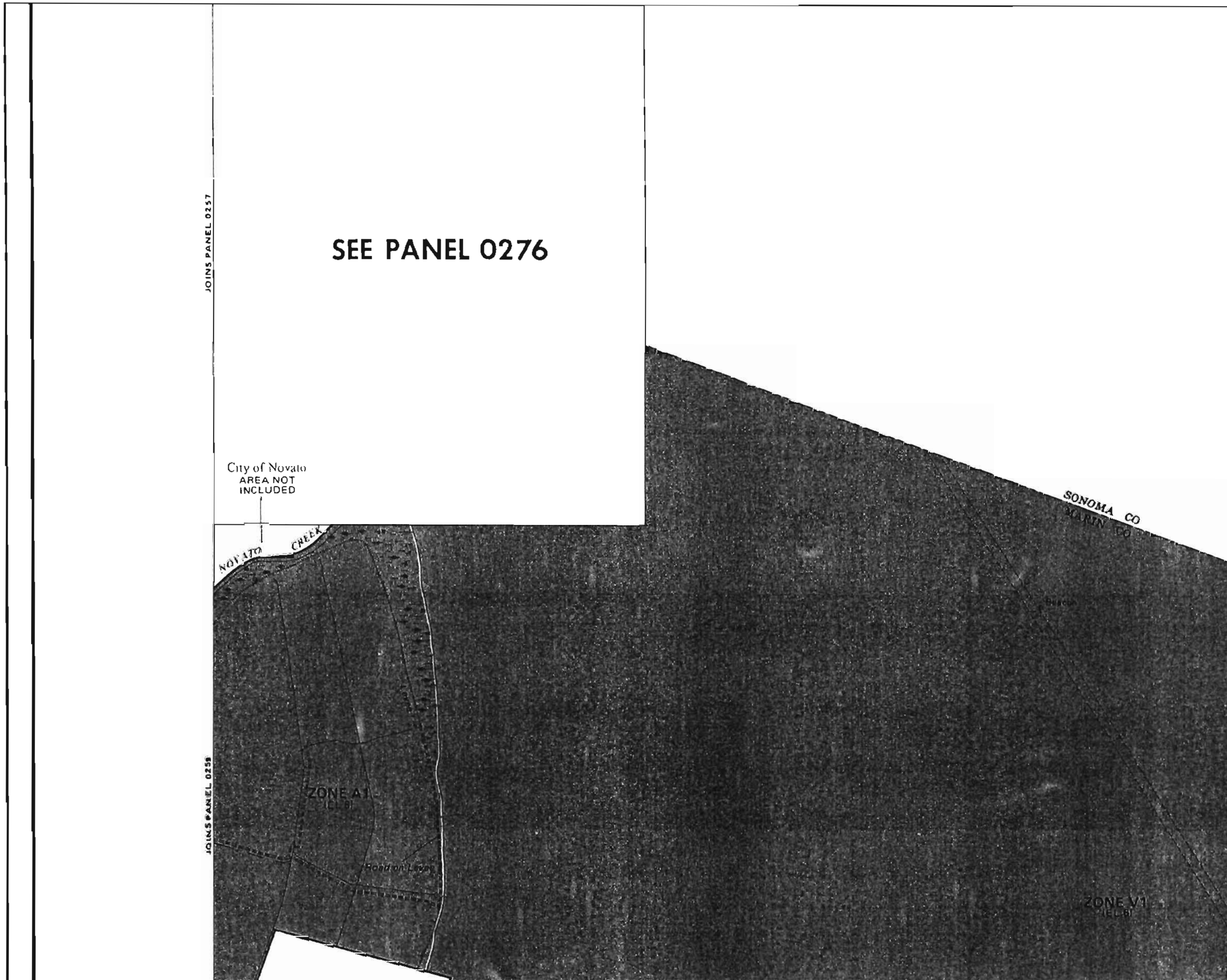
MARIN COUNTY, CALIFORNIA
(UNINCORPORATED AREAS)

PANEL 259 OF 525
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060173 0259 A

EFFECTIVE DATE:
MARCH 1, 1982

Federal Emergency Management Agency



APPROXIMATE SCALE

2000 0 2000 FE

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARIN COUNTY, CALIFORNIA (UNINCORPORATED AREAS)

PANEL 300 OF 525

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060173 0300 A

EFFECTIVE DATE:
MAY 3, 1982

Federal Emergency Management Agency

Appendix D

Special-Status Plant and Animal Species Table and USFWS and NMFS Correspondence

Table D-1. Special-Status Plant and Animal Species that Occur or Have Potential to Occur in or near the Proposed Wetland Restoration Site

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Plants				
California suaeda (*Suaeda california*)	E/--/1B	Margins of coastal salt marsh	Extirpated from San Francisco Bay area; known only from Morro Bay	None observed during rare plant surveys
Fragrant fritilary (*Fritilaria liliacea*)	--/--/1B	Coastal prairie, coastal scrub, valley and foothill grassland; often on serpentinite	Central coastal counties	Habitat at HAAF and the project area not likely to be suitable; none observed during rare plant surveys
Marin dwarf-flax (*Hesperolinon congestum*)	T/T/1B	Serpentine soils in grassland or chaparral habitats	San Francisco Bay area	No suitable habitat at HAAF and study area; none seen during field surveys
Marin knotweed (*Polygonum marinense*)	--/--/3	Coastal salt marsh	Marin, Napa, and Sonoma Counties	None observed during rare plant surveys
Mason's quilwort (*Liliaeopsis masonii*)	--/R/1B	Brackish and freshwater marshes and swamps, riparian scrub	San Francisco Bay and Delta areas	No suitable habitat in the project area; none observed during rare plant field surveys
Mount Tamalpais jewelflower (*Strepanthus glandulosus* spp. *pulchellus*)	--/--1B	Chaparral and grasslands with serpentine soils	Marin County	No suitable habitat; none observed during rare plant field surveys
Petaluma popcornflower (*Plagiobothrys mollis* var. *vetitus*)	--/--/1A	Habitat requirements uncertain; possibly salt marsh or mesic grasslands	Known only from type speciment in 1988 near Petaluma	None observed during rare plant surveys
Point Reyes bird's-beak (*Cordylanthus maritimus* ssp. *palustris*)	--/--1B	Salt marshes	Northern California coastal counties	None observed during rare plant field surveys
Round-headed beaked-rush (*Rhynchospora globularis*)	--/--/2	Freshwater marsh	Sonoma County	None observed during field surveys

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*)	E/R/1B	Upper marsh elevations that are regularly inundated but above area receiving daily flooding	San Francisco Bay area counties	None observed during field surveys
Sonoma alopecurus (*Alopecurus aequalis* var. *sonomensis*)	E/--/1B	Wet meadows, freshwater marsh, and riaprian scrub	Marin and Sonoma Counties	Habitat unlikely to occur in the project area; none observed during rare plant field surveys at HAAF
Suisun thistle (*Cirsium hydrophilium* var. *hydrophilum*)	E/--/1B	Brackish tidal marsh and salt marsh	Solano County	None observed during rare plant field surveys at HAAF
Swamp harebell (*Campanula californica*)	--/--/1B	Freshwater marsh, bogs, and mesic sites in conifer forests and grasslands	Central and northern counties of California	Habitat unlikely to occur in the project area; none observed during rare plant field surveys at HAAF
Thurber's reed grass (*Calamagrostis crassiglumis*)	--/--1B	Freshwater and mesic sites in coastal prairie	Northern California counties	None observed during rare plant field surveys at HAAF
Invertebrates				
California freshwater shrimp (*Syncaris pacifica*)	E/E/--	Occurs in coastal streams	Coastal northern California	No records; no suitable stream habitat
Ricksecker's water scavenger beetle (*Hydrochara rickseckeri*)	SC/--/--	Occurs in streams	San Francisco Bay area	No records; nearest record is at Bolinas; no suitable habitat at project site
San Francisco fortail damselfly (*Ischnura gemina*)	SC/--/--	Occurs in slow-moving streams and channels	San Francisco Bay area	No records; drainage channel near HAAF is considered marginal-quality habitat
Marin elfin butterfly (*Incisalia mossii*)	SC/--/--	Occurs in Marin County where Pacific stonecrop occurs	Marin County	No records; Pacific stonecrop was not found in the project area; no suitable habitat is present

Table D-1. Continued

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Fish				
Tidewater goby (*Eucyclogobius newberryi*)	E/SSC/--	Shallow lagoons and lower reaches of streams	Coastal California	Observed at mouth of Novato Creek in 1945, although not assumed to be present any longer; tidal marshes in the project area and channel at project site are considered marginal-quality habitat
Sacramento splittail (*Pogonichthys macrokepidotus*)	T/SSC/--	Generally restricted to tidal freshwater and low-salinity habitats	Generally upstream of San Pablo Bay	No records; no suitable habitat in the project area
Longfin smelt (*Spirinchus thaleichthys*)	SC/SSC/--	Spawns in lower Sacramento-San Joaquin River and Suisun Bay; prespawning adults and juveniles inhabit shoal areas of San Pablo Bay	Lower Sacramento-San Joaquin River, Suisun Bay, and San Pablo Bay	Could occur in or near the tidal marsh at and adjacent to HAAF
Central Valley Steelhead (*Oncorhynchus mykiss*)	T/SSC/--	Spawns in fresh water; juveniles rear in fresh and estuarine water before migrating to the ocean	Central Valley rivers and streams	Juveniles migrating to the ocean may use these areas to rear. Steelhead known in Novato Creek.
Chinook Salmon:		Spawns in fresh water; juveniles rear in fresh and estuarine water before migrating to the ocean	Central Valley rivers and streams	Juveniles migrating to the ocean may use these areas to rear; San Pablo Bay is within the critical habitat defined for winter-run chinook salmon. Chinook reported in Arroyo San Jose in 2001.
winter-run	E/E/--			
spring-run	T/C/--			
fall and late fall-run (*Oncorhynchus tshawytscha*)	PT/SSC/--			

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Amphibians				
California tiger salamander (*Ambystoma californiense*)	C/SSC/--	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy; does not occur in brackish water or saltwater habitats	Central Valley, including Sierra Nevada foothills, up to approximately 1,000 feet, and coastal region from Butte County south to Santa Barbara County	No records; no suitable freshwater habitat; not expected to occur in the project area
California red-legged frog (*Rana aurora draytonii*)	T/SSC/--	Permanent and semipermanent aquatic habitats, such as creeks and coldwater ponds, with emergent and submergent vegetation and riparian species along the edges; may estivate in rodent burrows or cracks during dry periods	Found along the coast and coastal mountain ranges of California from Shasta County to San Diego County; Sierra Nevada from Butte County to Fresno County	No records from surveys conducted in the HAAF or BMKV (Environmental Science Associates 1993) area; no suitable freshwater habitat; not expected to occur in the project area
Foothill yellow-legged frog (*Rana boylii*)	SC/SCC/--	Creeks or rivers in woodlands or forests with rock and gravel substrate and low overhanging vegetation along the edge; usually found near riffles with rocks and sunny banks nearby	Occurs in the Klamath, Cascade, north Coast, south Coast, and Transverse Ranges; through the Sierra Nevada foothills up to approximately 6,000 feet (1,800 meters) south to Kern County	No records; no suitable habitat
Western spadefoot toad (*Scaphiopus hammondii*)	SC/SCC/--	Shallow streams with riffles and seasonal wetlands, such as vernal pools in annual grasslands and oak woodlands	Sierra Nevada foothills, Central Valley, Coast Ranges, coastal counties in southern California	No records; no suitable freshwater habitat; not expected to occur in the project area

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Reptiles				
Northwestern pond turtle (*Clemmys marmorata marnorata*)	SC/SCC/--	Woodlands, grasslands, and open forests; occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation	In California, range extends from Oregon border of Del Norte and Siskiyou Counties south along the coast to San Francisco Bay, inland through Sacramento Valley, and on the western slope of Sierra Nevada; range overlaps with that of southwestern pond turtle through the Delta and Central Valley to Tulare County	Recorded in Pacheco Pond along HAAF boundary.
Southwestern pond turtle (*Clemmys marmorata pallida*)	SC/SCC/--	Woodlands, grasslands, and open forests; occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation	Occurs along the central coast of California east to the Sierra Nevada and along the southern California coast inland to the Mojave and Sonora Deserts; range overlaps with that of the northwestern pond turtle throughout the Delta and in the Central Valley from Sacramento County to Tulare County	No records; could occur in Pacheco Pond, but none were seen during field surveys
California horned lizard (*Phrynosoma coronatum frontale*)	SC/SSC/--	Grasslands, woodlands, and shrublands	Northern California, north of Los Angeles County	No records; potential low-quality habitat exists at HAAF; none were seen during field surveys

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Birds				
California brown pelican (*Pelecanus occidentalis californicus*)	E/E/--	Nests on coastal cliffs; forages in deep water	Coastal California	No suitable nesting habitat; salt marsh in the project area could provide seasonal foraging habitat; could occur year round in open water, but on an irregular basis; none observed onsite during field surveys. Observed in San Pablo Bay off outboard area.
Double-crested cormorant (*Phalacrocorax auritus*)	--/SSC/--	Winters along the entire California coast and inland over the Coast Ranges into the Central Valley from Tehama County to Fresno County; a permanent resident along the coast from Monterey County to San Diego County, along the Colorado River, Imperial, Riverside, Kern, and King Counties, and the islands off San Francisco; breeds in Siskiyou, Modoc, Lassen, Shasta, Plumas, and Mono Counties; also breeds in the San Francisco Bay area and in Yolo and Sacramento Counties	Rocky coastlines, beaches, inland ponds, and lakes; needs open water for foraging, and nests in riparian forests or on protected islands, usually in snags	No records; no suitable nesting habitat; observed just outside the saltwater marsh and in the wider channels in the marsh at HAAF
Ferruginous hawk (*Buteo regalis*)	SC/SSC/--	Open terrain in plains and foothills where ground squirrels and other prey are available	Does not nest in California; winter visitor throughout lowland California,, especially in agricultural areas, grassland and savanna	Potential winter visitor; could occur irregularly and in low numbers in the project area
Cooper's Hawk (*Acciptier cooperi*)	--/SSC/--			Recorded occasionally on HAAF site in 1997; no nesting habitat on HAAF site observed.

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Sharp-Shinned Hawk *(Accipiter striatus)*	--/SSC/--			Recorded occasionally on HAAF in 1997, no nesting habitat found on HAAF.
Merlin *(Falco columbarius)*	--/SSC/--			Recorded occasionally on the HAAF site in 1997; does not nest in California.
Northern Harrier (*Circus cyaneus*)	--/SSC/--	Grasslands, meadows, marshes, and seasonal and agricultural wetlands providing tall cover	Throughout lowland California; has been recorded in migration at high elevations	Common with 10 seen foraging in fields on January 30, 2002; two harriers were observed foraging in the salt marsh during 1994; another harrier was observed nesting in the HAAF area during 1994 and 1997 surveys
White-tailed kite (*Elanus leucurus*)	--/FP/--	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging	Lowland areas west of Sierra Nevada from head of Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border	Common with 8 seen foraging in fileds on January 30, 2002; nesting not documented yet but probably nests within the project area; nearest known nesting site is approximately 0.5 mile northwest of Novato; suitable foraging habitat occurs in grassland, agricultural, and marsh habitats
Loggerhead shrike *(Lanius ludovicianus)*	--/SSC/--			Recorded on HAAF site in 1997, no nesting records on HAAF site.
Osprey *(Pandion haliaetus)*	--/SSC/--			Recorded on HAAF site in 1997; also observed perching in trees by Pacheco Pond near HAAF

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Bald eagle (*Haliaeetus leucocephalus*)	T/E/--	In western North America, nests and roosts in coniferous forests and woodlands within 1 mile of a lake, a reservoir, a stream, or the ocean	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in the Lake Tahoe Basin; reintroduced into the central coast area; winter range includes the rest of California, except the southeastern deserts, very high altitudes in the Sierras, and east of the Sierra Nevada south of Mono County; range expanding into the western Sierra Nevada foothills	Potential occasional forager on HAAF; no suitable nesting habitat in the project area; not a known wintering area
Prairie Falcon *(Falco mexicanus)*	--/SSC/--			Recorded occasionally on HAAF site in 1997, no nesting habitat on HAAF site.
American peregrine falcon (*Falco preregrinus anatum*)	E/E/--	Nests and roosts on protected ledges of high cliffs, usually adjacent to lakes, rivers, or marshes that support large populations of other bird species	Permanent resident of the north and south Coast Ranges; may summer on the Cascade and Klamath Ranges south through the Sierra Nevada to Madera County; winters in the Central Valley south through the Transverse and Peninsular Ranges and the plains east of the Cascade Range	No suitable nesting habitat; potential occasional visitor during migration and in winter; recorded foraging on HAAF in 1997.

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
California black rail (*Laterallus jamaicensis coturniculus*)	SC/T/--	Tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations	Permanent resident in the San Francisco Bay and east-ward through the Delta into Sacramento and San Joaquin Counties; small populations in Marin, Santa Cruz, San Luis Obispo, Orange, Riverside, and Imperial Counties	The tidal marsh provides high-quality nesting and foraging habitat; observed in the salt marsh at HAAF (Garcia per. comm.); known in Novato Creek marshes.
California clapper rail (*Rallus longirostris obsoletus*)	E/E/--	Restricted to salt marshes and tidal sloughs; usually associated with heavy growth of pickleweed; feeds on mollusks removed from mud in sloughs	Marshes around San Francisco Bay and east through the Delta to Suisun Marsh	Tidal marsh provides high-quality nesting and foraging habitat; observed in salt marsh at HAAF(Garcia per. comm.); known in Novato Creek marsh.
Western snowy plover (coastal population) (*Charadrius alexandrinus nivosus*)	T/SCC/--	Nests on open, flat beaches and alkali flats; forages on beaches and mudflats	Coastal California including the San Francisco Bay Area	No records; no suitable nesting habitat; could forage in seasonal wetlands and mudflats in the project area
California least tern (*Sterna antillarum browni*)	E/E/--	Nests on sandy, upper ocean beaches, and occasionally uses mudflats; forages on adjacent surf line, estuaries, or the open ocean	Nests on beaches along the San Francisco Bay and Delta and along the southern California coast from southern San Luis Obispo County south to San Diego County	No records; no suitable nesting habitat; could forage in shallow water beyond the salt marsh
Short-eared owl (*Asio flammeus*)	--/SSC/--	Nests and forages in grasslands and marsh habitats	Throughout lowland California	One observed on January 30, 2002; salt marsh and fields within the project area are suitable nesting and foraging habitat; recorded on HAAF site in 1997.

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Western burrowing owl (*Athene cunicularia hypugea*)	SC/SSC/--	Rodent burrows in sparse grassland, desert, and agricultural habitats	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along south coast	Formerly nested along the edges of the runway and levees at HAAF; none observed during 1994 field surveys; LSA found and passively relocated 7-9 individuals from HAAF site in 1997; could be a winter visitor, irregular visitor, or resident
Little willow flycatcher (*Empidonax traillii brewsteri*)	SC/E/--	Riparian areas and large, wet meadows with abundant willows for breeding; usually found in riparian habitats during migration	Summer range includes a narrow strip along the eastern Sierra Nevada from Shasta County to Kern County and another strip along the western Sierra Nevada from El Dorado County to Madera County; widespread in migration	No records; no suitable nesting habitat occurs in the project area; potential occasional forager on HAAF site.
Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)	SC/SSC/--	Freshwater marshes in summer and salt or brackish marshes in fall and winter; requires tall grasses, tules, and willow thickets for nesting and cover	Found only in the San Francisco Bay area in Marin, Napa, Sonoma, Solano, San Francisco, San Mateo, Santa Clara, and Alameda Counties	Suitable habitat occurs in tidal marshes in the project area; observed at the project area in coastal salt marsh; previously observed in or near confluence of Arroyo San Jose and Pacheco Creek.

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Bell's sage sparrow (*Amphispiza belli belli*)	SC/SCC/--	Prefers chaparral habitats dominated by chamise	Western Sierra foothills from El Dorado County south to Mariposa County, inner Coast Ranges from Shasta County southward, extending to coastal area from Marin County to San Diego County; from southern San Benito County to San Bernardino County; absent from innermost Coast Ranges and desert slopes of San Gabriel and San Bernardino Mountains	No records; no suitable habitat
San Pablo song sparrow (*Melospiza melodia samuelis*)	SC/SCC/--	Brackish and tidal marshes supporting cattails, tules, various sedges, pickleweed, and riparian scrub	Restricted to San Pablo Bay area	Suitable tidal marsh habitat occurs in the project area; observed in saltmarsh habitat during 1994, 1997 and 2002
Mammals				
Suisun ornate shrew (*Sorex ornatus sinuosus*)	SC/SSC/--	Tidal, salt, and brackish marshes containing pickleweed, grindelia, bulrushes, or cattails; requires driftwood or other objects for nesting cover	Restricted to San Pablo Bay and Suisun Bay, both in Solano County	No records; not likely to occur in the project area
Greater mastiff bat (*Eumops perotis callifornicus*)	SC/SSC/--	Roosts and breeds in deep, narrow rock crevices; may also use crevices in trees, buildings, and tunnels; forages in a variety of semiarid to arid habitats	Occurs along the eastern San Joaquin Valley from El Dorado County through Kern County; also found along the south Coast, Peninsular, and Transverse Ranges from San Francisco to the Mexico border	No records; suitable roosting sites exist in the project area, but no presence of species found on BMKV site.

Common and Scientific Name	Legal Status[a] Federal/State /CNPS	Habitat Requirements	Distribution in California	Occurrence in the Project Area
Long-eared myotis (*Myotis evotis*)	SC/--/--	Woodlands	Sierra Nevada, Klamath Mountains, Coast Ranges, and Transverse and Peninsular Ranges	The project area is at the edge of the species' range; no suitable roosting sites
Fringed myotis (*Myotis thysanodes*)	SC/--/--	Open woodlands	Sierra Nevada, Klamath Mountains, Coast Ranges, and Transverse and Peninsular Ranges	The project area is at the edge of the species' range; no suitable roosting sites
Long-legged myotis (*Myotis volans*)	SC/--/--	Most common in woodlands and forests above 4,000 feet, but occurs from sea level to 11,000 feet	Mountains throughout California	The project area is at the edge of the species' range; no suitable roosting sites
Yuma myotis (*Myotis yumanensis*)	SC/--/--	Roosts colonially in a variety of natural and human-made sites, including caves, mines, buildings, bridges, and trees; in northern California, maternity colonies are usually in fire-scarred redwoods, pines, or oaks; forages for insects over water bodies	Considered common and widespread in northern California; colonies known from Marin and San Francisco Counties	The project area is at the edge of the species' range; suitable roosting sites exist in project area, but no presence of species found on BMKV site.
Pacific western big-eared bat (*Plecotus townsendii townsendii*)	SC/SSC/--	Roosts in caves, tunnels, mines, and dark attics of abandoned buildings; very sensitive to disturbances and may abandon a roost after onsite visit	Coastal regions from Del Norte County south to Santa Barbara County	No records; suitable roosting sites exist in the project area, but no presence of species found on BMKV site.
Saltmarsh harvest mouse (*Reithrodontomys raviventris*)	E/E and FP/--	Brackish and salt marshes; primarily associated with pickleweed	San Francisco, San Pablo, and Suisun Bays; western most portion of the Delta	Suitable habitat exists along the salt marshes in the project area; assumed to occur in the salt marsh in the project area
Point Reyes jumping mouse (*Zapus trinotatus orarius*)	SC/SSC	Wet, marshy areas and closed forests	Confined to the Point Reyes area	No records; no suitable habitat

Note: Unless otherwise indicated, all survey results are taken from U.S. Army Corps of Engineers 1996.

[a] Status explanations:

Federal

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

PE = proposed for federal listing as endangered under the federal Endangered Species Act.

PT = proposed for federal listing as threatened under the federal Endangered Species Act.

C = species for which USFWS has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list, but issuance of the proposed rule is precluded.

SC = species of concern; species for which existing information indicates it may warrant listing but for which substantial biological information to support a proposed rule is lacking.

-- = no listing.

State

E = listed as endangered under the California Endangered Species Act.

T = listed as threatened under the California Endangered Species Act.

R = listed as rare under the California Native Plant Protection Act. This category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation.

FP = fully protected under the California Fish and Game Code.

SSC= species of special concern in California.

-- = no listing.

California Native Plant Society

1A = List 1A species: presumed extinct in California.

1B = List 1B species: rare, threatened, or endangered in California and elsewhere.

2 = List 2 species: rare, threatened, or endangered in California but more common elsewhere.

3 = List 3 species: plants about which more information is needed to determine their status.

-- = no listing.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W2605
Sacramento, California 95825

IN REPLY REFER TO:
1-1-02-SP-0683

January 23, 2002

Rich Walter
Jones & Stokes
268 Grand Avenue
Oakland, California 94610

Subject: Species List for Bel Marin Keys Unit V Wetland Restoration Project

Dear Mr. Walter:

We are sending the enclosed list in response to your 1/18/02 request for information about endangered and threatened species (Enclosure A). The list covers the following U.S. Geological Survey 7 1/2 minute quads:

466A	RICHMOND
466B	SAN QUENTIN
467A	SAN RAFAEL
467B	BOLINAS
483A	CUTTINGS WHARF
483B	SEARS POINT
483C	PETALUMA POINT
483D	MARE ISLAND
484A	PETALUMA RIVER
484B	PETALUMA
484C	SAN GERONIMO
484D	NOVATO

Please note that the lists now contain "species of local concern or conservation significance," as identified in recovery plans. National Marine Fisheries Service species are also now identified as such.

Please read Important Information About Your Species List (enclosed). It explains how we made the list and describes your responsibilities under the Endangered Species Act. Contact Dan Buford, Branch Chief, at (916) 414-6625, if you have any questions about the attached list or your responsibilities under the Endangered Species Act.

For the fastest response to species list requests, address them to the attention of Harry Mossman at this address. You may fax requests to him at 414-6710 or email them to harry_mossman@fws.gov.

Sincerely,

Harry Mossman

Jan C. Knight, Chief
Endangered Species Division

Enclosures

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute *quads*. The United States is divided into these quads, which are about the size of San Francisco. If you requested your list by quad name or number, that is what we used. Otherwise, we used the information you sent us to determine which quad or quads to use.

The animals on your species list are ones that occur within, *or may be affected by projects within*, the quads covered by the list. Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them. Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents. Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regard-less of whether they appear on a quad list.
Plants

Any plants on your list are ones *that have actually been observed* in the quad or quads covered by the list. We have also included either a county species list or a list of species in nearby quads. We recommend that you check your project area for these plants. Plants may exist in an area without ever having been detected there.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list. For plant surveys, we recommend using the enclosed *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Species*. The results of your surveys should be published in any environmental documents prepared for your project.

State-Listed Species

If a species has been listed as threatened or endangered by the State of California, but not by us nor by the National Marine Fisheries Service, it will appear on your list as a Species of Concern. *However you should contact the California Department of Fish and Game for official information about these species.* Call (916) 322-2493 or write Marketing Manager, California Department of Fish and Game, Natural Diversity Data Base, 1416 Ninth Street, Sacramento, California 95814.

Your Responsibilities Under the Endangered Species Act

All plants and animals identified as *listed* on Enclosure A are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the *take* of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal. Take may include significant habitat

modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a *formal consultation* with the Service. During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a *biological opinion* by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an *incidental take permit*. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project. Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compen-sates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as *critical habitat*. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Maps and boundary descriptions of the critical habitat may be found in the *Federal Register*. The information is also reprinted in the *Code of Federal Regulations* (50 CFR 17.95).

Candidate Species

We recommend that you address impacts to *candidate* species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Your list may contain a section called *Species of Concern*. This term includes former *category 2 candidate species* and other plants and animals of concern to the Service and other Federal, State and

private conservation agencies and organizations. Some of these species may become candidate species in the future.

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed, candidate and special concern species in your planning, this should not be a problem. We also continually strive to make our information as accurate as possible. Sometimes we learn that a particular species has a different range than we thought. This should not be a problem if you consider the species on the county or surrounding-quad lists that we have enclosed.

To update your list, get an informal list from our web page: http://sacramento.fws.gov/es.

GUIDELINES FOR CONDUCTING AND REPORTING BOTANICAL INVENTORIES FOR FEDERALLY LISTED, PROPOSED AND CANDIDATE PLANTS

(September 23, 1996)

These guidelines describe protocols for conducting botanical inventories for federally listed, proposed and candidate plants, and describe minimum standards for reporting results. The Service will use, in part, the information outlined below in determining whether the project under consideration may affect any listed, proposed or candidate plants, and in determining the direct, indirect, and cumulative effects.

Field inventories should be conducted in a manner that will locate listed, proposed, or candidate species (target species) that may be present. The entire project area requires a botanical inventory, except developed agricultural lands. The field investigator(s) should:

1. Conduct inventories at the appropriate times of year when target species are present and identifiable. Inventories will include all potential habitats. Multiple site visits during a field season may be necessary to make observations during the appropriate phenological stage of all target species.

2. If available, use a regional or local reference population to obtain a visual image of the target species and associated habitat(s). If access to reference populations is not available, investigators should study specimens from local herbaria.

3. List every species observed and compile a comprehensive list of vascular plants for the entire project site. Vascular plants need to be identified to a taxonomic level which allows rarity to be determined.

4. Report results of botanical field inventories that include:

   a. a description of the biological setting, including plant community, topography, soils, potential habitat of target species, and an evaluation of environmental conditions, such as timing or quantity of rainfall, which may influence the performance and expression of target species

   b. a map of project location showing scale, orientation, project boundaries, parcel size, and map quadrangle name

   c. survey dates and survey methodology(ies)

   d. if a reference population is available, provide a written narrative describing the target species reference population(s) used, and date(s) when observations were made

   e. a comprehensive list of all vascular plants occurring on the project site for each habitat type

   f. current and historic land uses of the habitat(s) and degree of site alteration

   g. presence of target species off-site on adjacent parcels, if known

   h. an assessment of the biological significance or ecological quality of the project site in a local and regional context

5. If target species is(are) found, report results that additionally include:

   a. a map showing federally listed, proposed and candidate species distribution as they relate to the proposed project

   b. if target species is (are) associated with wetlands, a description of the direction and integrity of flow of surface hydrology. If target species is (are) affected by adjacent off-site hydrological influences, describe these factors.

   c. the target species phenology and microhabitat, an estimate of the number of individuals of each target species per unit area; identify areas of high, medium and low density of target species over the project site, and provide acres of occupied habitat of target species. Investigators could provide color slides, photos or color copies of photos of target species or representative habitats to support information or descriptions contained in reports.

   d. the degree of impact(s), if any, of the proposed project as it relates to the potential unoccupied habitat of target habitat.

6. Document findings of target species by completing California Native Species Field Survey Form(s) and submit form(s) to the Natural Diversity Data Base. Documentation of determinations and/or voucher specimens may be useful in cases of taxonomic ambiguities, habitat or range extensions.

7. Report as an addendum to the original survey, any change in abundance and distribution of target plants in subsequent years. Project sites with inventories older than three years from the current date of project proposal submission will likely need additional survey. Investigators need to assess whether an additional survey(s) is (are) needed.

8. Adverse conditions may prevent investigator(s) from determining presence or identifying some target species in potential habitat(s) of target species. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any year. An additional botanical inventory(ies) in a subsequent year(s) may be required if adverse conditions occur in a potential habitat(s). Investigator(s) may need to discuss such conditions.

9. Guidance from California Department of Fish and Game (CDFG) regarding plant and plant community surveys can be found in Guidelines for Assessing the Effects of Proposed Developments on Rare and Endangered Plants and Plant Communities, 1984. Please contact the CDFG Regional Office for questions regarding the CDFG guidelines and for assistance in determining any applicable State regulatory requirements.

ENCLOSURE A

Endangered and Threatened Species that May Occur In
or be Affected by Projects in the Selected Quads Listed Below
Reference File No. 1-1-02-SP-0683
Bel Marin Keys Unit V Wetland Restoration Project
January 23, 2002

QUAD: 466A RICHMOND

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

Reptiles

Alameda whipsnake, *Masticophis lateralis euryxanthus* (T)

Critical habitat, Alameda whipsnake, *Masticophis lateralis euryxanthus* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

Critical habitat, delta smelt, *Hypomesus transpacificus* (T)

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Plants

pallid manzanita (=Alameda or Oakland Hills manzanita), *Arctostaphylos pallida* (T)

Critical habitat, Santa Cruz tarplant, *Holocarpha macradenia* (T)

Santa Cruz tarplant, *Holocarpha macradenia* (T)

Candidate Species

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

small-footed myotis bat, *Myotis ciliolabrum* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

San Francisco dusky-footed woodrat, *Neotoma fuscipes annectens* (SC)

salt marsh vagrant shrew, *Sorex vagrans halicoetes* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

Bell's sage sparrow, *Amphispiza belli belli* (SC)

short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugeea* (SC)

Aleutian Canada goose, *Branta canadensis leucopareia* (D)

ferruginous hawk, *Buteo regalis* (SC)

Costa's hummingbird, *Calypte costae* (SC)

Vaux's swift, *Chaetura vauxi* (SC)

black tern, *Chlidonias niger* (SC)

black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

American peregrine falcon, *Falco peregrinus anatum* (D)

saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)

loggerhead shrike, *Lanius ludovicianus* (SC)

black rail, *Laterallus jamaicensis coturniculus* (CA)

Lewis' woodpecker, *Melanerpes lewis* (SC)

Alameda (South Bay) song sparrow, *Melospiza melodia pusillula* (SC)

San Pablo song sparrow, *Melospiza melodia samuelis* (SC)

long-billed curlew, *Numenius americanus* (SC)

bank swallow, *Riparia riparia* (CA)

rufous hummingbird, *Selasphorus rufus* (SC)

Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

southwestern pond turtle, *Clemmys marmorata pallida* (SC)

California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

foothill yellow-legged frog, *Rana boylii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Bridges' Coast Range shoulderband snail, *Helminthoglypta nickliniana bridgesi* (SC)

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

San Francisco lacewing, *Nothochrysa californica* (SC)

Plants

alkali milk-vetch, *Astragalus tener var. tener* (SC) *

salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)

fragrant fritillary, *Fritillaria liliacea* (SC) *

Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)

most beautiful (uncommon) jewelflower, *Streptanthus albidus ssp. peramoenus* (SC)

QUAD: 466B SAN QUENTIN

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

delta smelt, *Hypomesus transpacificus* (T)
Critical habitat, coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS
coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS
Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS
Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS
Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS
Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS
Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Plants

Tiburon mariposa lily, *Calochortus tiburonensis* (T)
Tiburon paintbrush, *Castilleja affinis ssp. neglecta* (E)
Marin dwarf-flax, *Hesperolinon congestum* (T)
white-rayed pentachaeta, *Pentachaeta bellidiflora* (E) *
Tiburon jewelflower, *Streptanthus niger* (E)
showy Indian clover, *Trifolium amoenum* (E) *

Candidate Species

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS
Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)
greater western mastiff-bat, *Eumops perotis californicus* (SC)
long-eared myotis bat, *Myotis evotis* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
long-legged myotis bat, *Myotis volans* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
San Francisco dusky-footed woodrat, *Neotoma fuscipes annectens* (SC)
salt marsh vagrant shrew, *Sorex vagrans halicoetes* (SC)
Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)
grasshopper sparrow, *Ammodramus savannarum* (SC)
Bell's sage sparrow, *Amphispiza belli belli* (SC)
short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)
ferruginous hawk, *Buteo regalis* (SC)
Costa's hummingbird, *Calypte costae* (SC)
Vaux's swift, *Chaetura vauxi* (SC)
black tern, *Chlidonias niger* (SC)
black swift, *Cypseloides niger* (SC)
hermit warbler, *Dendroica occidentalis* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
American peregrine falcon, *Falco peregrinus anatum* (D)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
Harlequin duck, *Histrionicus histrionicus* (SC)
loggerhead shrike, *Lanius ludovicianus* (SC)
black rail, *Laterallus jamaicensis coturniculus* (CA)
Lewis' woodpecker, *Melanerpes lewis* (SC)
San Pablo song sparrow, *Melospiza melodia samuelis* (SC)
long-billed curlew, *Numenius americanus* (SC)
bank swallow, *Riparia riparia* (CA)
rufous hummingbird, *Selasphorus rufus* (SC)
Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles
northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians
Northern red-legged frog, *Rana aurora aurora* (SC)
foothill yellow-legged frog, *Rana boylii* (SC)

Fish
green sturgeon, *Acipenser medirostris* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates
Opler's longhorn moth, *Adela oplerella* (SC)
Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)
Marin elfin butterfly, *Incisalia mossii* (SC)
Tiburon microblind harvestman, *Microcina tiburona* (SC)

Plants
salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)
Franciscan thistle, *Cirsium andrewsii* (SC)

northcoast bird's-beak, *Cordylanthus maritimus ssp. palustris* (SLC) *
Tiburon tarplant, *Hemizonia multicaulis ssp. vernalis* (SC)
Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)

QUAD: 467A SAN RAFAEL

Listed Species

Mammals

Guadalupe fur seal, *Arctocephalus townsendi* (T) NMFS
sei whale, *Balaenoptera borealis* (E) NMFS
blue whale, *Balaenoptera musculus* (E) NMFS
finback (=fin) whale, *Balaenoptera physalus* (E) NMFS
right whale, *Eubalaena glacialis* (E) NMFS
sperm whale, *Physeter catodon (=macrocephalus)* (E) NMFS
salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

Critical habitat, marbled murrelet, *Brachyramphus marmoratus* (T)
marbled murrelet, *Brachyramphus marmoratus* (T)
bald eagle, *Haliaeetus leucocephalus* (T)
California brown pelican, *Pelecanus occidentalis californicus* (E)
California clapper rail, *Rallus longirostris obsoletus* (E)
California least tern, *Sterna antillarum (=albifrons) browni* (E)
northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)
delta smelt, *Hypomesus transpacificus* (T)
Critical habitat, coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS
coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS
Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS
Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS
winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
California coastal chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS
Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS
Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS
Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

white abalone, *Haliotes sorenseni* (E) NMFS

Myrtle's silverspot butterfly, *Speyeria zerene myrtleae* (E)

Plants

Marin dwarf-flax, *Hesperolinon congestum* (T)

Santa Cruz tarplant, *Holocarpha macradenia* (T) *

white-rayed pentachaeta, *Pentachaeta bellidiflora* (E) *

Proposed Species

Birds

short-tailed albatross, *Diomedea albatrus* (E)

Candidate Species

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Invertebrates

black abalone, *Haliotes cracherodii* (C) NMFS

Species of Concern

Mammals

Point Reyes mountain beaver, *Aplodontia rufa phaea* (SC)

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

gray whale, *Eschrichtius robustus* (D) NMFS

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

Bell's sage sparrow, *Amphispiza belli belli* (SC)

short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

Vaux's swift, *Chaetura vauxi* (SC)

black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

American peregrine falcon, *Falco peregrinus anatum* (D)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
Harlequin duck, *Histrionicus histrionicus* (SC)
loggerhead shrike, *Lanius ludovicianus* (SC)
black rail, *Laterallus jamaicensis coturniculus* (CA)
Lewis' woodpecker, *Melanerpes lewis* (SC)
long-billed curlew, *Numenius americanus* (SC)
ashy storm-petrel, *Oceanodroma homochroa* (SC)
bank swallow, *Riparia riparia* (CA)
rufous hummingbird, *Selasphorus rufus* (SC)
Allen's hummingbird, *Selasphorus sasin* (SC)
elegant tern, *Sterna elegans* (SC)

Reptiles
northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians
Northern red-legged frog, *Rana aurora aurora* (SC)
foothill yellow-legged frog, *Rana boylii* (SC)

Fish
Pacific lamprey, *Lampetra tridentata* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates
Opler's longhorn moth, *Adela oplerella* (SC)
sandy beach tiger beetle, *Cicindela hirticollis gravida* (SC)
globose dune beetle, *Coelus globosus* (SC)
Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)
Marin elfin butterfly, *Incisalia mossii* (SC)
bumblebee scarab beetle, *Lichnanthe ursina* (SC)

Plants
Tamalpais manzanita, *Arctostaphylos hookeri ssp. montana* (SC)
marsh milkvetch (=brine milk-vetch, =marsh locoweed), *Astragalus pycnostachyus var. pycnostachyus* (SLC)
salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)
San Francisco Bay spineflower, *Chorizanthe cuspidata var. cuspidata* (SC)
Franciscan thistle, *Cirsium andrewsii* (SC)
Mt. Tamalpais thistle, *Cirsium hydrophilum var. vaseyi* (SC)
Round-headed Chinese houses, *Collinsia corymbosa* (SC) *?
northcoast bird's-beak, *Cordylanthus maritimus ssp. palustris* (SLC)

woolly-headed gilia, *Gilia capitata ssp. tomentosa* (SC) *
San Francisco gumplant, *Grindelia hirsutula var. maritima* (SC)
Diablo helianthella (=rock-rose), *Helianthella castanea* (SC) *
Tiburon tarplant, *Hemizonia multicaulis ssp. vernalis* (SC)
Tamalpais lessingia, *Lessingia micradenia var. micradenia* (SC)
Santa Cruz microseris, *Microseris decipiens* (SC)
curly-leaved (=curlyleaf) monardella, *Monardella undulata* (SC) *?
Gairdner's yampah, *Perideridia gairdneri ssp. gairdneri* (SC)
hairless allocarya (=popcornflower), *Plagiobothrys glaber* (SLC) **
northcoast semaphore grass, *Pleuropogon hooverianus* (SC)
Marin knotweed, *Polygonum marinense* (SLC)
Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)
Tamalpais streptanthus, *Streptanthus batrachopus* (SC)

QUAD: 467B BOLINAS

Listed Species

Mammals

Guadalupe fur seal, *Arctocephalus townsendi* (T) NMFS
sei whale, *Balaenoptera borealis* (E) NMFS
blue whale, *Balaenoptera musculus* (E) NMFS
finback (=fin) whale, *Balaenoptera physalus* (E) NMFS
right whale, *Eubalaena glacialis* (E) NMFS
Critical Habitat, Steller (=northern) sea-lion, *Eumetopias jubatus* (T) NMFS
Steller (=northern) sea-lion, *Eumetopias jubatus* (T) NMFS
sperm whale, *Physeter catodon (=macrocephalus)* (E) NMFS

Birds

Critical habitat, marbled murrelet, *Brachyramphus marmoratus* (T)
marbled murrelet, *Brachyramphus marmoratus* (T)
western snowy plover, *Charadrius alexandrinus nivosus* (T)
bald eagle, *Haliaeetus leucocephalus* (T)
California brown pelican, *Pelecanus occidentalis californicus* (E)
California clapper rail, *Rallus longirostris obsoletus* (E) *
California least tern, *Sterna antillarum (=albifrons) browni* (E)
northern spotted owl, *Strix occidentalis caurina* (T)

Reptiles

loggerhead turtle, *Caretta caretta* (T) NMFS
green turtle, *Chelonia mydas (incl. agassizi)* (T) NMFS
leatherback turtle, *Dermochelys coriacea* (E) NMFS

olive (=Pacific) ridley sea turtle, *Lepidochelys olivacea* (T) NMFS

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

delta smelt, *Hypomesus transpacificus* (T)

Critical habitat, coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

California coastal chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

white abalone, *Haliotes sorenseni* (E) NMFS

Myrtle's silverspot butterfly, *Speyeria zerene myrtleae* (E)

Plants

Sonoma alopecurus, *Alopecurus aequalis var. sonomensis* (E)

Marin dwarf-flax, *Hesperolinon congestum* (T)

showy Indian clover, *Trifolium amoenum* (E) *

Proposed Species

Birds

short-tailed albatross, *Diomedea albatrus* (E)

Candidate Species

Invertebrates

black abalone, *Haliotes cracherodii* (C) NMFS

Species of Concern

Mammals

Point Reyes mountain beaver, *Aplodontia rufa phaea* (SC)

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

gray whale, *Eschrichtius robustus* (D) NMFS

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)
grasshopper sparrow, *Ammodramus savannarum* (SC)
Bell's sage sparrow, *Amphispiza belli belli* (SC)
short-eared owl, *Asio flammeus* (SC)
western burrowing owl, *Athene cunicularia hypugaea* (SC)
ferruginous hawk, *Buteo regalis* (SC)
Vaux's swift, *Chaetura vauxi* (SC)
black swift, *Cypseloides niger* (SC)
hermit warbler, *Dendroica occidentalis* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
American peregrine falcon, *Falco peregrinus anatum* (D)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
Harlequin duck, *Histrionicus histrionicus* (SC)
loggerhead shrike, *Lanius ludovicianus* (SC)
black rail, *Laterallus jamaicensis coturniculus* (CA)
Lewis' woodpecker, *Melanerpes lewis* (SC)
long-billed curlew, *Numenius americanus* (SC)
ashy storm-petrel, *Oceanodroma homochroa* (SC)
bank swallow, *Riparia riparia* (CA)
rufous hummingbird, *Selasphorus rufus* (SC)
Allen's hummingbird, *Selasphorus sasin* (SC)
elegant tern, *Sterna elegans* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)

Fish

Pacific lamprey, *Lampetra tridentata* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Opler's longhorn moth, *Adela oplerella* (SC)
sandy beach tiger beetle, *Cicindela hirticollis gravida* (SC)
globose dune beetle, *Coelus globosus* (SC)
Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)
Marin elfin butterfly, *Incisalia mossii* (SC)

bumblebee scarab beetle, *Lichnanthe ursina* (SC)

Plants

Tamalpais manzanita, *Arctostaphylos hookeri ssp. montana* (SC)

marsh milkvetch (=brine milk-vetch, =marsh locoweed), *Astragalus pycnostachyus var. pycnostachyus* (SLC)

salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)

Mason's ceanothus, *Ceanothus masonii* (SC)

Franciscan thistle, *Cirsium andrewsii* (SC)

Mt. Tamalpais thistle, *Cirsium hydrophilum var. vaseyi* (SC)

Round-headed Chinese houses, *Collinsia corymbosa* (SC) *?

northcoast bird's-beak, *Cordylanthus maritimus ssp. palustris* (SLC)

woolly-headed gilia, *Gilia capitata ssp. tomentosa* (SC) *

San Francisco gumplant, *Grindelia hirsutula var. maritima* (SC)

Tiburon tarplant, *Hemizonia multicaulis ssp. vernalis* (SC)

Tamalpais lessingia, *Lessingia micradenia var. micradenia* (SC)

large-flowered (=flower) linanthus, *Linanthus grandiflorus* (SC)

curly-leaved (=curlyleaf) monardella, *Monardella undulata* (SC)

Marin checkermallow, *Sidalcea hickmanii ssp. viridis* (SC)

Pacific cordgrass (=California cordgrass), *Spartina foliosa* (SLC)

Tamalpais streptanthus, *Streptanthus batrachopus* (SC)

QUAD: 483A CUTTINGS WHARF

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS
Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS
Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS
Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

vernal pool fairy shrimp, *Branchinecta lynchi* (T)
callippe silverspot butterfly, *Speyeria callippe callippe* (E)
California freshwater shrimp, *Syncaris pacifica* (E)

Plants

soft bird's-beak, *Cordylanthus mollis ssp. mollis* (E)
Contra Costa goldfields, *Lasthenia conjugens* (E)
showy Indian clover, *Trifolium amoenum* (E) *

Candidate Species

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS
Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)
greater western mastiff-bat, *Eumops perotis californicus* (SC)
long-eared myotis bat, *Myotis evotis* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
long-legged myotis bat, *Myotis volans* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)
grasshopper sparrow, *Ammodramus savannarum* (SC)
Bell's sage sparrow, *Amphispiza belli belli* (SC)
short-eared owl, *Asio flammeus* (SC)
western burrowing owl, *Athene cunicularia hypugaea* (SC)
ferruginous hawk, *Buteo regalis* (SC)
Vaux's swift, *Chaetura vauxi* (SC)
black tern, *Chlidonias niger* (SC)
black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
American peregrine falcon, *Falco peregrinus anatum* (D)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
loggerhead shrike, *Lanius ludovicianus* (SC)
black rail, *Laterallus jamaicensis coturniculus* (CA)
Lewis' woodpecker, *Melanerpes lewis* (SC)
San Pablo song sparrow, *Melospiza melodia samuelis* (SC)
long-billed curlew, *Numenius americanus* (SC)
bank swallow, *Riparia riparia* (CA)
rufous hummingbird, *Selasphorus rufus* (SC)
Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles
northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians
foothill yellow-legged frog, *Rana boylii* (SC)
western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish
green sturgeon, *Acipenser medirostris* (SC)
river lamprey, *Lampetra ayresi* (SC)
Pacific lamprey, *Lampetra tridentata* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates
Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Plants
Suisun Marsh aster, *Aster lentus* (SC)
San Joaquin spearscale (=saltbush), *Atriplex joaquiniana* (SC)
salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)
delta tule-pea, *Lathyrus jepsonii var. jepsonii* (SC)
legenere, *Legenere limosa* (SC)
Mason's lilaeopsis, *Lilaeopsis masonii* (SLC)
Marin knotweed, *Polygonum marinense* (SLC)
Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)

QUAD: 483B SEARS POINT

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

California freshwater shrimp, *Syncaris pacifica* (E)

Plants

Baker's stickyseed, *Blennosperma bakeri* (E)

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *?

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)
long-eared myotis bat, *Myotis evotis* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
long-legged myotis bat, *Myotis volans* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)
Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)
grasshopper sparrow, *Ammodramus savannarum* (SC)
Bell's sage sparrow, *Amphispiza belli belli* (SC)
short-eared owl, *Asio flammeus* (SC)
western burrowing owl, *Athene cunicularia hypugaea* (SC)
ferruginous hawk, *Buteo regalis* (SC)
Vaux's swift, *Chaetura vauxi* (SC)
black tern, *Chlidonias niger* (SC)
black swift, *Cypseloides niger* (SC)
hermit warbler, *Dendroica occidentalis* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
American peregrine falcon, *Falco peregrinus anatum* (D)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
loggerhead shrike, *Lanius ludovicianus* (SC)
black rail, *Laterallus jamaicensis coturniculus* (CA)
Lewis' woodpecker, *Melanerpes lewis* (SC)
San Pablo song sparrow, *Melospiza melodia samuelis* (SC)
long-billed curlew, *Numenius americanus* (SC)
bank swallow, *Riparia riparia* (CA)
rufous hummingbird, *Selasphorus rufus* (SC)
Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)
foothill yellow-legged frog, *Rana boylii* (SC)
western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

river lamprey, *Lampetra ayresi* (SC)

Pacific lamprey, *Lampetra tridentata* (SC)

longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Plants

salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)

Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)

water sack clover, *Trifolim depauperatum var. hydrophilum* (SC)

QUAD: 483C PETALUMA POINT

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS

Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

California freshwater shrimp, *Syncaris pacifica* (E)

Candidate Species

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)

Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

Bell's sage sparrow, *Amphispiza belli belli* (SC)

short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

Vaux's swift, *Chaetura vauxi* (SC)

black tern, *Chlidonias niger* (SC)

black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

American peregrine falcon, *Falco peregrinus anatum* (D)

saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)

loggerhead shrike, *Lanius ludovicianus* (SC)

black rail, *Laterallus jamaicensis coturniculus* (CA)

Lewis' woodpecker, *Melanerpes lewis* (SC)

San Pablo song sparrow, *Melospiza melodia samuelis* (SC)

long-billed curlew, *Numenius americanus* (SC)

bank swallow, *Riparia riparia* (CA)

rufous hummingbird, *Selasphorus rufus* (SC)

Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)

foothill yellow-legged frog, *Rana boylii* (SC)

western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)

river lamprey, *Lampetra ayresi* (SC)

Pacific lamprey, *Lampetra tridentata* (SC)

longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Marin elfin butterfly, *Incisalia mossii* (SC)

Plants

salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)

Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)

QUAD: 483D MARE ISLAND

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California brown pelican, *Pelecanus occidentalis californicus* (E)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Reptiles

Alameda whipsnake, *Masticophis lateralis euryxanthus* (T)

Critical habitat, Alameda whipsnake, *Masticophis lateralis euryxanthus* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

Critical habitat, delta smelt, *Hypomesus transpacificus* (T)

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS
Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS
Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS
Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS
Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS
Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

callippe silverspot butterfly, *Speyeria callippe callippe* (E)
California freshwater shrimp, *Syncaris pacifica* (E)

Plants

soft bird's-beak, *Cordylanthus mollis ssp. mollis* (E)

Candidate Species

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS
Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)
greater western mastiff-bat, *Eumops perotis californicus* (SC)
long-eared myotis bat, *Myotis evotis* (SC)
fringed myotis bat, *Myotis thysanodes* (SC)
long-legged myotis bat, *Myotis volans* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
San Francisco dusky-footed woodrat, *Neotoma fuscipes annectens* (SC)
Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)
salt marsh vagrant shrew, *Sorex vagrans halicoetes* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)
grasshopper sparrow, *Ammodramus savannarum* (SC)
Bell's sage sparrow, *Amphispiza belli belli* (SC)
short-eared owl, *Asio flammeus* (SC)
western burrowing owl, *Athene cunicularia hypugaea* (SC)
ferruginous hawk, *Buteo regalis* (SC)
Costa's hummingbird, *Calypte costae* (SC)
Vaux's swift, *Chaetura vauxi* (SC)

black tern, *Chlidonias niger* (SC)
black swift, *Cypseloides niger* (SC)
hermit warbler, *Dendroica occidentalis* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
American peregrine falcon, *Falco peregrinus anatum* (D)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
loggerhead shrike, *Lanius ludovicianus* (SC)
black rail, *Laterallus jamaicensis coturniculus* (CA)
Lewis' woodpecker, *Melanerpes lewis* (SC)
San Pablo song sparrow, *Melospiza melodia samuelis* (SC)
long-billed curlew, *Numenius americanus* (SC)
bank swallow, *Riparia riparia* (CA)
rufous hummingbird, *Selasphorus rufus* (SC)
Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
southwestern pond turtle, *Clemmys marmorata pallida* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

foothill yellow-legged frog, *Rana boylii* (SC)
western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

green sturgeon, *Acipenser medirostris* (SC)
river lamprey, *Lampetra ayresi* (SC)
Pacific lamprey, *Lampetra tridentata* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Plants

Suisun Marsh aster, *Aster lentus* (SC)
salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)
Mason's lilaeopsis, *Lilaeopsis masonii* (SLC)
Pacific cordgrass (=California cordgrass), *Sparina foliosa* (SLC)

QUAD: 484A PETALUMA RIVER

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California clapper rail, *Rallus longirostris obsoletus* (E)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS

Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS

Invertebrates

California freshwater shrimp, *Syncaris pacifica* (E)

Plants

soft bird's-beak, *Cordylanthus mollis ssp. mollis* (E) *

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *?

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS

Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Point Reyes mountain beaver, *Aplodontia rufa phaea* (SC)

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)

Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

Bell's sage sparrow, *Amphispiza belli belli* (SC)

short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

Vaux's swift, *Chaetura vauxi* (SC)

black tern, *Chlidonias niger* (SC)

black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

American peregrine falcon, *Falco peregrinus anatum* (D)

saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)

loggerhead shrike, *Lanius ludovicianus* (SC)

Lewis' woodpecker, *Melanerpes lewis* (SC)

San Pablo song sparrow, *Melospiza melodia samuelis* (SC)

long-billed curlew, *Numenius americanus* (SC)

bank swallow, *Riparia riparia* (CA)

rufous hummingbird, *Selasphorus rufus* (SC)

Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)

foothill yellow-legged frog, *Rana boylii* (SC)

western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

Pacific lamprey, *Lampetra tridentata* (SC)

longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Marin blind harvestman, *Calicina diminua* (SC)

Sonoma arctic skipper, *Carterocephalus palaemon ssp* (SC)

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Plants

salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)

fragrant fritillary, *Fritillaria liliacea* (SC)

Petaluma popcornflower, *Plagiobothrys mollis var. vestitus* (SLC) *

Marin knotweed, *Polygonum marinense* (SLC)

QUAD: 484B PETALUMA

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

bald eagle, *Haliaeetus leucocephalus* (T)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

California coastal chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Invertebrates

Myrtle's silverspot butterfly, *Speyeria zerene myrtleae* (E)

California freshwater shrimp, *Syncaris pacifica* (E)

Plants

Baker's larkspur, *Delphinium bakeri* (E)

showy Indian clover, *Trifolium amoenum* (E) *

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *?

Species of Concern

Mammals

Point Reyes mountain beaver, *Aplodontia rufa phaea* (SC)

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)
long-legged myotis bat, *Myotis volans* (SC)
Yuma myotis bat, *Myotis yumanensis* (SC)
Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)
grasshopper sparrow, *Ammodramus savannarum* (SC)
short-eared owl, *Asio flammeus* (SC)
western burrowing owl, *Athene cunicularia hypugaea* (SC)
ferruginous hawk, *Buteo regalis* (SC)
Vaux's swift, *Chaetura vauxi* (SC)
black tern, *Chlidonias niger* (SC)
black swift, *Cypseloides niger* (SC)
hermit warbler, *Dendroica occidentalis* (SC)
white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)
little willow flycatcher, *Empidonax traillii brewsteri* (CA)
American peregrine falcon, *Falco peregrinus anatum* (D)
saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)
loggerhead shrike, *Lanius ludovicianus* (SC)
Lewis' woodpecker, *Melanerpes lewis* (SC)
long-billed curlew, *Numenius americanus* (SC)
bank swallow, *Riparia riparia* (CA)
rufous hummingbird, *Selasphorus rufus* (SC)
Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)
California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)
foothill yellow-legged frog, *Rana boylii* (SC)

Fish

Pacific lamprey, *Lampetra tridentata* (SC)
longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Sonoma arctic skipper, *Carterocephalus palaemon ssp* (SC)
Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Plants

alkali milk-vetch, *Astragalus tener var. tener* (SC) *

Petaluma popcornflower, *Plagiobothrys mollis var. vestitus* (SLC) *

QUAD: 484C SAN GERONIMO

Listed Species

Birds

Critical habitat, marbled murrelet, *Brachyramphus marmoratus* (T)

marbled murrelet, *Brachyramphus marmoratus* (T)

bald eagle, *Haliaeetus leucocephalus* (T)

California least tern, *Sterna antillarum (=albifrons) browni* (E)

northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)

delta smelt, *Hypomesus transpacificus* (T)

coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS

Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS

Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS

California coastal chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS

Invertebrates

Myrtle's silverspot butterfly, *Speyeria zerene myrtleae* (E)

California freshwater shrimp, *Syncaris pacifica* (E)

Plants

Tiburon paintbrush, *Castilleja affinis ssp. neglecta* (E)

Marin dwarf-flax, *Hesperolinon congestum* (T) *

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *?

Species of Concern

Mammals

Point Reyes mountain beaver, *Aplodontia rufa phaea* (SC)

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

Vaux's swift, *Chaetura vauxi* (SC)

black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

American peregrine falcon, *Falco peregrinus anatum* (D)

saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)

loggerhead shrike, *Lanius ludovicianus* (SC)

Lewis' woodpecker, *Melanerpes lewis* (SC)

long-billed curlew, *Numenius americanus* (SC)

ashy storm-petrel, *Oceanodroma homochroa* (SC)

bank swallow, *Riparia riparia* (CA)

rufous hummingbird, *Selasphorus rufus* (SC)

Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

Northern red-legged frog, *Rana aurora aurora* (SC)

foothill yellow-legged frog, *Rana boylii* (SC)

Fish

Pacific lamprey, *Lampetra tridentata* (SC)

longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

sandy beach tiger beetle, *Cicindela hirticollis gravida* (SC)

globose dune beetle, *Coelus globosus* (SC)

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Marin elfin butterfly, *Incisalia mossii* (SC)

Plants

marsh milkvetch (=brine milk-vetch, =marsh locoweed), *Astragalus pycnostachyus var. pycnostachyus* (SLC

fragrant fritillary, *Fritillaria liliacea* (SC)
Tiburon tarplant, *Hemizonia multicaulis ssp. vernalis* (SC)
northcoast semaphore grass, *Pleuropogon hooverianus* (SC)

QUAD: 484D NOVATO

Listed Species

Mammals

salt marsh harvest mouse, *Reithrodontomys raviventris* (E)

Birds

western snowy plover, *Charadrius alexandrinus nivosus* (T)
bald eagle, *Haliaeetus leucocephalus* (T)
California brown pelican, *Pelecanus occidentalis californicus* (E)
California clapper rail, *Rallus longirostris obsoletus* (E)
California least tern, *Sterna antillarum (=albifrons) browni* (E)
northern spotted owl, *Strix occidentalis caurina* (T)

Amphibians

California red-legged frog, *Rana aurora draytonii* (T)

Fish

tidewater goby, *Eucyclogobius newberryi* (E)
delta smelt, *Hypomesus transpacificus* (T)
coho salmon - central CA coast, *Oncorhynchus kisutch* (T) NMFS
Central California Coastal steelhead, *Oncorhynchus mykiss* (T) NMFS
Central Valley steelhead, *Oncorhynchus mykiss* (T) NMFS
winter-run chinook salmon, *Oncorhynchus tshawytscha* (E) NMFS
Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (T) NMFS
Critical Habitat, Central Valley spring-run chinook, *Oncorhynchus tshawytscha* (T) NMFS
Sacramento splittail, *Pogonichthys macrolepidotus* (T)

Invertebrates

California freshwater shrimp, *Syncaris pacifica* (E)

Plants

Marin dwarf-flax, *Hesperolinon congestum* (T)

Candidate Species

Birds

Western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (C) *?

Fish

Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha* (C) NMFS
Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha* (C) NMFS

Species of Concern

Mammals

Point Reyes mountain beaver, *Aplodontia rufa phaea* (SC)

Pacific western big-eared bat, *Corynorhinus (=Plecotus) townsendii townsendii* (SC)

greater western mastiff-bat, *Eumops perotis californicus* (SC)

long-eared myotis bat, *Myotis evotis* (SC)

fringed myotis bat, *Myotis thysanodes* (SC)

long-legged myotis bat, *Myotis volans* (SC)

Yuma myotis bat, *Myotis yumanensis* (SC)

Suisun ornate shrew, *Sorex ornatus sinuosus* (SC)

Point Reyes jumping mouse, *Zapus trinotatus orarius* (SC)

Birds

tricolored blackbird, *Agelaius tricolor* (SC)

grasshopper sparrow, *Ammodramus savannarum* (SC)

Bell's sage sparrow, *Amphispiza belli belli* (SC)

short-eared owl, *Asio flammeus* (SC)

western burrowing owl, *Athene cunicularia hypugaea* (SC)

ferruginous hawk, *Buteo regalis* (SC)

Vaux's swift, *Chaetura vauxi* (SC)

black tern, *Chlidonias niger* (SC)

black swift, *Cypseloides niger* (SC)

hermit warbler, *Dendroica occidentalis* (SC)

white-tailed (=black shouldered) kite, *Elanus leucurus* (SC)

little willow flycatcher, *Empidonax traillii brewsteri* (CA)

American peregrine falcon, *Falco peregrinus anatum* (D)

saltmarsh common yellowthroat, *Geothlypis trichas sinuosa* (SC)

loggerhead shrike, *Lanius ludovicianus* (SC)

black rail, *Laterallus jamaicensis coturniculus* (CA)

Lewis' woodpecker, *Melanerpes lewis* (SC)

San Pablo song sparrow, *Melospiza melodia samuelis* (SC)

long-billed curlew, *Numenius americanus* (SC)

bank swallow, *Riparia riparia* (CA)

rufous hummingbird, *Selasphorus rufus* (SC)

Allen's hummingbird, *Selasphorus sasin* (SC)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (SC)

California horned lizard, *Phrynosoma coronatum frontale* (SC)

Amphibians

foothill yellow-legged frog, *Rana boylii* (SC)

western spadefoot toad, *Scaphiopus hammondii* (SC)

Fish

Pacific lamprey, *Lampetra tridentata* (SC)

longfin smelt, *Spirinchus thaleichthys* (SC)

Invertebrates

Ricksecker's water scavenger beetle, *Hydrochara rickseckeri* (SC)

Marin elfin butterfly, *Incisalia mossii* (SC)

Plants

salt marsh owl's clover (=johnny-nip), *Castilleja ambigua ssp. ambigua* (SLC)

northcoast bird's-beak, *Cordylanthus maritimus ssp. palustris* (SLC)

fragrant fritillary, *Fritillaria liliacea* (SC)

Pacific cordgrass (=California cordgrass), *Spartina foliosa* (SLC)

KEY:

(E)	*Endangered*	Listed (in the Federal Register) as being in danger of extinction.
(T)	*Threatened*	Listed as likely to become endangered within the foreseeable future.
(P)	*Proposed*	Officially proposed (in the Federal Register) for listing as endangered or threatened.
(PX)	*Proposed Critical Habitat*	Proposed as an area essential to the conservation of the species.
(C)	*Candidate*	Candidate to become a *proposed* species.
(SC)	*Species of Concern*	May be endangered or threatened. Not enough biological information has been gathered to support listing at this time.
(SLC)	*Species of Local Concern*	Species of local or regional concern or conservation significance.
(MB)	*Migratory Bird*	Migratory bird
NMFS	NMFS species	Under the jurisdiction of the National Marine Fisheries Service. Contact them directly.
(D)	*Delisted*	Delisted. Status to be monitored for 5 years.
(CA)	*State-Listed*	Listed as threatened or endangered by the State of California.
(*)	*Extirpated*	Possibly extirpated from this quad.
(**)	*Extinct*	Possibly extinct.
	Critical Habitat	Area essential to the conservation of a species.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404

In response refer to:
MAR - 6 2002 151422SWR02SR6233:ES

Rich Walter, Project Manager
Jones and Stokes
268 Grand Avenue
Oakland, California 94610

Dear Mr. Walter:

Thank you for your letter of January 18, 2002, regarding the presence of Federally listed (or proposed for listing) threatened or endangered species or critical habitat that may be affected by the Bel Marin Keys Unit V Wetland Restoration project in Novato, California.

Endangered Species Act
Available information indicates that the following species may occur in the project area:

Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*)
endangered (January 4, 1994, 59 FR 440)
critical habitat (June 16, 1993, 58 FR 33212)
Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*)
threatened (September 16, 1999, 64 FR 50394)
critical habitat (February 16, 2000, 65 FR 7764)
Central California Coast steelhead (*Oncorhynchus mykiss*)
threatened (August 18, 1997, 62 FR 43937)
critical habitat (February 16, 2000, 65 FR 7764)
Central Valley steelhead (*Oncorhynchus mykiss*)
threatened (March 19, 1998, 63 FR 13347)
critical habitat (February 16, 2000, 65 FR 7764)

The U.S. Fish and Wildlife Service (USFWS) may also have listed species or critical habitat under its jurisdiction in the project area. Please contact Mr. Harry Mossman at USFWS, 2800 Cottage Way, W-2605, Sacramento, California 95825, or (916) 414-6600, regarding the presence of listed species or critical habitat under USFWS jurisdiction that might be affected by your project.

Magnuson-Stevens Act – Essential Fish Habitat
The project location is also designated as Essential Fish Habitat (EFH) for fish species managed with the following Fishery Management Plans (FMP) under the Magnuson-Stevens Fishery Conservation and Management Act:

Pacific Groundfish Fishery Management Plan
Coastal Pelagics Fishery Management Plan
Pacific Coast Salmon Fishery Management Plan

Amendments to the MSFCMA in 1996 require Federal agencies to consult with NMFS regarding any action or proposed action that may adversely affect EFH for federally managed fish species. For more information on EFH, see our website at www.swr.nmfs.noaa.gov. Please send an EFH assessment to NMFS if the Federal action agency determines that the proposed action may adversely affect EFH for any species in the FMPs listed above.

If available, NMFS requests information in digital format such as maps of the project area, aquatic and terrestrial habitats, wetland classification, and any other relevant data layers be provided with the initiation of the Endangered Species Act consultation and/or EFH Assessment. NMFS would prefer maps in a Geographic Information System (GIS) format compatible with ArcView or Arc Info.

If you have questions concerning these comments, please contact Erik Schmidt of my staff at (707) 575-6083.

Sincerely,

Patrick J. Rutten
Northern California Supervisor
Protected Resources Division

cc: Jim Lecky, NMFS Long Beach

Appendix E

Air Quality Conformity Determination

Appendix E
Conformity Analysis

The air quality conformity analysis examined two aspects of construction regarding potential air analysis:

- construction equipment and worker commutes associated with on-site earthmoving activity; and
- construction phase emissions related to unloading of dredge material from dredge scows onto the site.

The conformity analysis was done for ozone precursors, specifically, reactive organic gases (ROG), and oxides of nitrogen (NOx), due to the non-attainment status of the San Francisco Bay Area for ozone.

Alternative 1 and 2, which involve the most amount of earthmoving and the most amount of dredge material placement was analyzed. If the analysis indicated that Alternatives 1 and 2 would be under the general conformity thresholds, then no analysis would be necessary for the Alternative 3.

Air quality impacts associated with dredging and transportation of dredged material, including air quality, are not analyzed in this document because they have or will be analyzed in the NEPA/CEQA documents prepared for individual dredging projects that may propose to dispose of appropriate dredged material at the BMKV wetland restoration site.

Onshore Construction Vehicle Activity Emissions Estimates

This section describes the methodology used to estimate the number of construction vehicles, employees, and worker commute trips associated with restoration construction activity.

As described in the Alternatives Description, each of the action alternatives includes three phases: Phase 1 – Site Preparation; Phase 2- Dredged Material Placement; and Phase 3 - Earthwork and Tidal Reconnection.

Phase 1 - Site Preparation will take approximately 1-2 years and will including onsite soil salvage and moving of soil, construction of temporary and permanent levees, and channel excavation. Phase 2 - Dredged Material Placement will take approximately 10 years in Alternatives 1 and 2; Phase 3 earthwork and tidal connection would take six months to one year. The total construction period would extend approximately 13 years in Alternatives 1 and 2, due to the length of time required to place dredged material. The most intensive onshore construction vehicle period is Phase 1 because it would involve the most construction vehicle and earthmoving activity. Phase 2, the dominant emissions activity is associated with offloading and placement of dredged material. Construction activity during Phase 1 was assumed to be conducted 8 hours a day for 200 days per year.

Construction Vehicles

The type and number of construction vehicles needed for Phase 1 construction were estimated. For this project, a maximum of eight scrapers and two compactors/ rollers would be needed for earthmoving and levee construction in Phase 1. These estimates are based on the total levee square footage and a 2-year time period to complete construction of the levees. Scrapers were assumed to be the primary type of equipment because they would be used to create the levees and berms using existing soil at the project site. The use of more than eight scrapers for this project could result in congestion problems because the vehicles would start to interfere with each other. A maximum of two compactors/rollers would be needed to compact soil as the levees are built up by the scrapers.

In addition to the scrapers and rollers, one loader and five dump trucks were assumed to be needed because a portion of the total levee fill may be obtained from on-site locations at distances that prevent the use of scrapers to obtain the needed fill material and potentially off-site locations. Additional support equipment, including a fuel supply truck, a water supply truck (for wetting down dry soil), a maintenance worker vehicle, and two pickup trucks. A total of twenty construction vehicles are assumed to be used at the peak of Phase 1 earthmoving and levee construction.

Construction Employees

The number of employees was estimated by assuming one employee per construction vehicle, for a total of 20 employees.

Daily Commute Trips

The number of daily worker trips was estimated. Thirty-eight daily trips were estimated for this project: 17 trips during the morning commute, 17 trips during the evening commute, and 10 trips during the lunch hour. The 17 trips during the morning and evening commutes assume that 14 workers commute in single-

occupant vehicles and that six workers commute in three double-occupant vehicles. During the lunch hour, 10 of the 17 vehicles were assumed to be used to buy lunch and run errands.

Construction (Onshore) Emissions Estimate

The highest level of worker commute trips would be generated during the first 2 years (Phase 1). During that time, site preparation including earthmoving and levee and berm construction would be performed. That construction effort is estimated to require 20 construction vehicles, 20 workers and to generate 17 trips during the morning and evening commute periods and 10 trips during the lunch hour.

As shown in Table E-1, the estimates of total annual emissions from construction vehicle activity of NOx and ROG during Phase 1 are 25.4 tons and 1.8 tons, respectively.

Dredged Material Unloading Emissions Estimates

This section describes the methodology used to estimate the emissions associated with unloading of dredge material and pumping it into wetland restoration cells at the HWRP including the BMKV site. This activity would take place during Phase 2- Dredged Material Placement. Estimates were prepared for use of marine support vessels and support equipment, for use of diesel unloading and booster pumps, for an alternative of using electrified pumps instead of diesel pumps, and for several hybrid scenarios. This estimate was prepared by Moffitt, Nichol.

Dredged Material Unloading Emission Estimate

Three scenarios of annual dredged material unloading amounts were considered: (1) a low-volume scenario (250,000 CY), (2) a medium-volume scenario (1.25 MCY); and (3) a high-volume scenario (3.5 MCY).

Nitrogen oxides (NOx) is one of the critical pollutants found in diesel exhaust. Nitrogen oxides are active ozone precursors. For this study, emissions for NOx were estimated as an indicator of unloading equipment that may pose a regulatory concern.

Estimates of air emissions were based on hours of operation for the following equipment:

- Unloader – Main pump (4000 hp), jet pump (800 hp), snorkel (800 hp) and generator (250 hp)

- Booster – Main pump (7200 hp) and generator (180 hp)
- Work Tug (750 hp)
- Crew Boat (400 hp)
- Loader (275 hp)
- Hydracrane (130 hp) – 2 each
- Dozer (165 hp) – 2 each

The equipment size (hp) was based largely on existing equipment of similar purpose.

Operating and standby hours were estimated for the unloader system. The total hours were based on 7 days a week, 24 hours a day. Standby time was separated as operational versus non-operational standby. For operational standby, it was assumed that only the generators would be operating. The generators would continue to provide power to the unloader (e.g. instruments, winches, office, lights) and booster although no pumps would be operating. The workday was still considered a 24-hour day. For non-operational standby, it was assumed that only the generators would be operating, but only for 8-hour days rather than 24-hour days.

Emissions were estimated using emission factors for the equipment described above. Factors for the unloader and booster were based on existing equipment of similar purpose and age. Three conditions for the power source were used to estimate emissions from the engines – unmitigated, mitigated and electrified. For the unmitigated case, all equipment was assumed to be diesel-powered with engines typical of existing equipment. For the mitigated case, it was assumed that emission reduction technology would be implemented on the main engines of the unloader and booster pump only. The reduction was based on the use of selective catalytic reduction (SCR) to the engines. SCR is an exhaust-after treatment and usually requires exhaust gas temperature between 600°F and 750°F. SCR is considered very effective in reducing NOx emissions; in excess of 90 percent.

For the HWRP project, unloader operations will include periods of time that the engines will be on standby prior to pumping. During the operational time for unloading the scows, the engine exhaust temperature will initially be less than required for SCR. To allow for warm-up time for the exhaust temperature, we have reduced the effectiveness of the SCR to account for a 30-minute warm-up period during a single scow offload time of 110 minutes. Therefore, for this study, the adjusted effectiveness of the SCR was reduced to 73 percent and that reduction factor was applied to the emission factors. For the electrified case, only the unloader and booster pumps were considered for electrification. All other equipment would remain diesel-powered.

Estimates of emissions were prepared for the following configurations:

- Unmitigated (all diesel equipment)
- Mitigated (Mitigate unloader and booster engines only)

- Electrified (unloader and booster)
- Electrified Booster/Diesel Unloader (unmitigated)
- Electrified Booster/Diesel Unloader (mitigated)

Dredged Material Unloading Emissions Estimate

As shown in Table E-2, the estimates of the unloading emissions vary significantly between the different equipment configurations and volume scenarios. In some cases, emissions would be above the 100 tons conformity threshold for NOx. Mitigation is recommended in Chapter 4 to reduce emissions below the conformity threshold.

Table E-1: Emissions Estimate for Construction Vehicles, Alternative 1 and 2

Commute Assumptions - Construction

	Commute	Lunch	Dump trucks	Pickup Trucks
Vehicles	17	10	5	2
Miles	15	5	10	10
trips/day	34	20	10	8
miles/day	510	100	100	80

Emission Factors (lbs/hr) - Construction

	ROG	NOx	Load Factor	Vehicles
Scraper	0.27	3.84	0.66	8
Roller/Compactor	0.065	0.87	0.575	2
Tracked Loader	0.095	0.83	0.465	1
Off-Highway Truck	0.19	4.17	0.41	2

Emission Factors (grams/mile) - Construction

	ROG	NOx	Load Factor
Dump Truck	1.22	8.45	1
Pick up Truck	0.24	0.6	1
Auto	0.2	0.39	1

Emisson in Tons/Year - Construction

	ROG	NOx
Emission for Construction	1.74	25.33
Emission for Commute/Lunch	0.03	0.07
Total Construction Vehicles	***1.8***	***25.4***

Table E-2: Emissions Estimate for Construction Vehicles, Alternative 1 & 2

Case	**1**	**2**	**3**
Dredge Material Placement Vol. (MCY)	0.25	1.25	3.50
Diesel Unloader (Unmitigated)			
Operating	47.23	118.65	332.92
Stand-by	21.70	19.75	13.89
Non-Operational Standby	0.00	0.00	0.00
Total	68.93	138.40	346.81
Diesel Unloader (Mitigated)			
Operating	18.68	46.94	131.70
Stand-by	21.70	19.75	13.89
Non-Operational Standby	0.00	0.00	0.00
Total	40.38	66.69	145.59
Electrified			
Operating	6.78	17.03	47.79
Stand-by	0.00	0.00	0.00
Non-Operational Standby	0.00	0.00	0.00
Total	6.78	17.03	47.79
Diesel Unloader (Unmitigated)/Elec. Booster			
Operating	23.56	59.19	166.06
Stand-by	12.00	10.92	7.68
Non-Operational Standby	0.00	0.00	0.00
Total	35.56	70.11	173.34
Diesel Unloader (Mitigated)/Elec. Booster			
Operating	11.85	29.77	83.54
Stand-by	12.00	10.92	7.68
Non-Operational Standby	0.00	0.00	0.00
Total	23.85	40.69	91.22

Appendix F

Aesthetics Line of Sight Analysis

Appendix F
Aesthetics Line of Sight Analysis

Key Viewpoints

Lines of sight from two of the five key viewpoints were determined using the methodology described below. Locations and directions of these viewpoints are identified in figure 4-16 and described below. The view from each of these viewpoints is also depicted in representative photographs shown in figure 4-17.

Viewpoint 2

Viewpoint 2 is located south of Viewpoint 1, at the eastern end of Bahama Reef in the BMK residential area. The view faces east towards San Pablo Bay. The viewshed primarily consists of the south lagoon in the foreground and flat, vegetated land in the middle ground and background. Views from this viewpoint are clear and unobstructed by utilities or other physical structures. San Pablo Bay is a small portion of the background view from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the outboard levee.

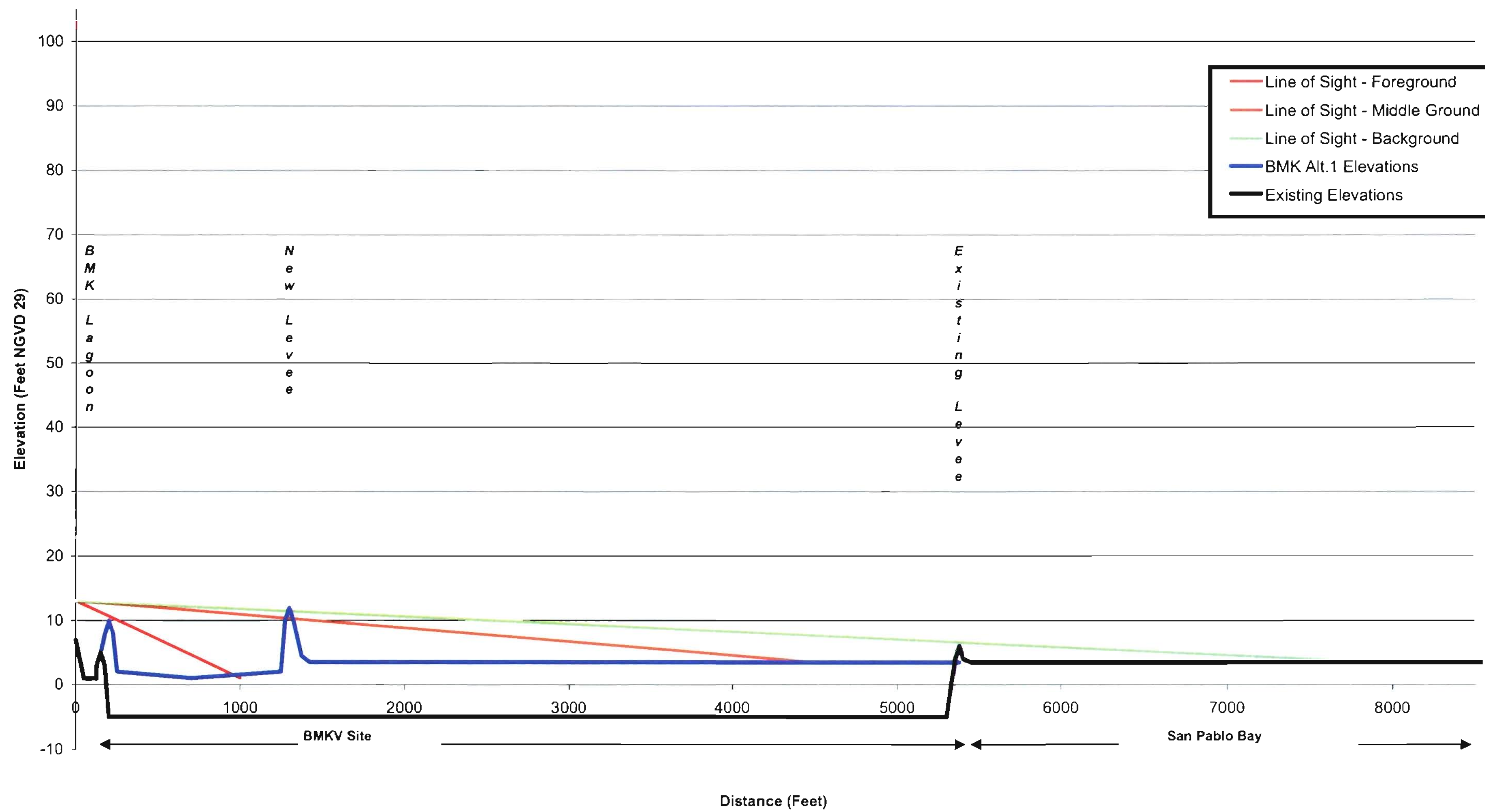
Viewpoint 3

Viewpoint 3 is located southwest of Viewpoint 2, at the southeastern end of Del Oro Lagoon in the BMK residential area. The view faces southeast towards HAAF and San Pablo Bay. The viewshed primarily consists of the south lagoon in the foreground, flat farmland in the middle ground, and isolated trees (on the SLC parcel) and distant rolling hills in the background. Views from this viewpoint are clear and unobstructed by utilities or other physical structures. San Pablo Bay is a small portion of the background view from street level/ground floor but is prominent from the second-story level. The view of the bay is partially obstructed by the outboard levee.

Visual lines of site were determined by using 2 elevations at the key viewpoints to represent street-level/ground-floor views (13 feet NGVD—7 feet for street level + 1.5 feet for foundation + 4.5 feet to viewer height) and second-story views (23 feet NGVD—ground floor + 10 feet) from the ends of southward-facing streets. Elevations of the existing site were identified from prior levee and topographic surveys. Elevations of the future site with implementation of the restoration alternatives were based on the conceptual designs described in chapter 3.

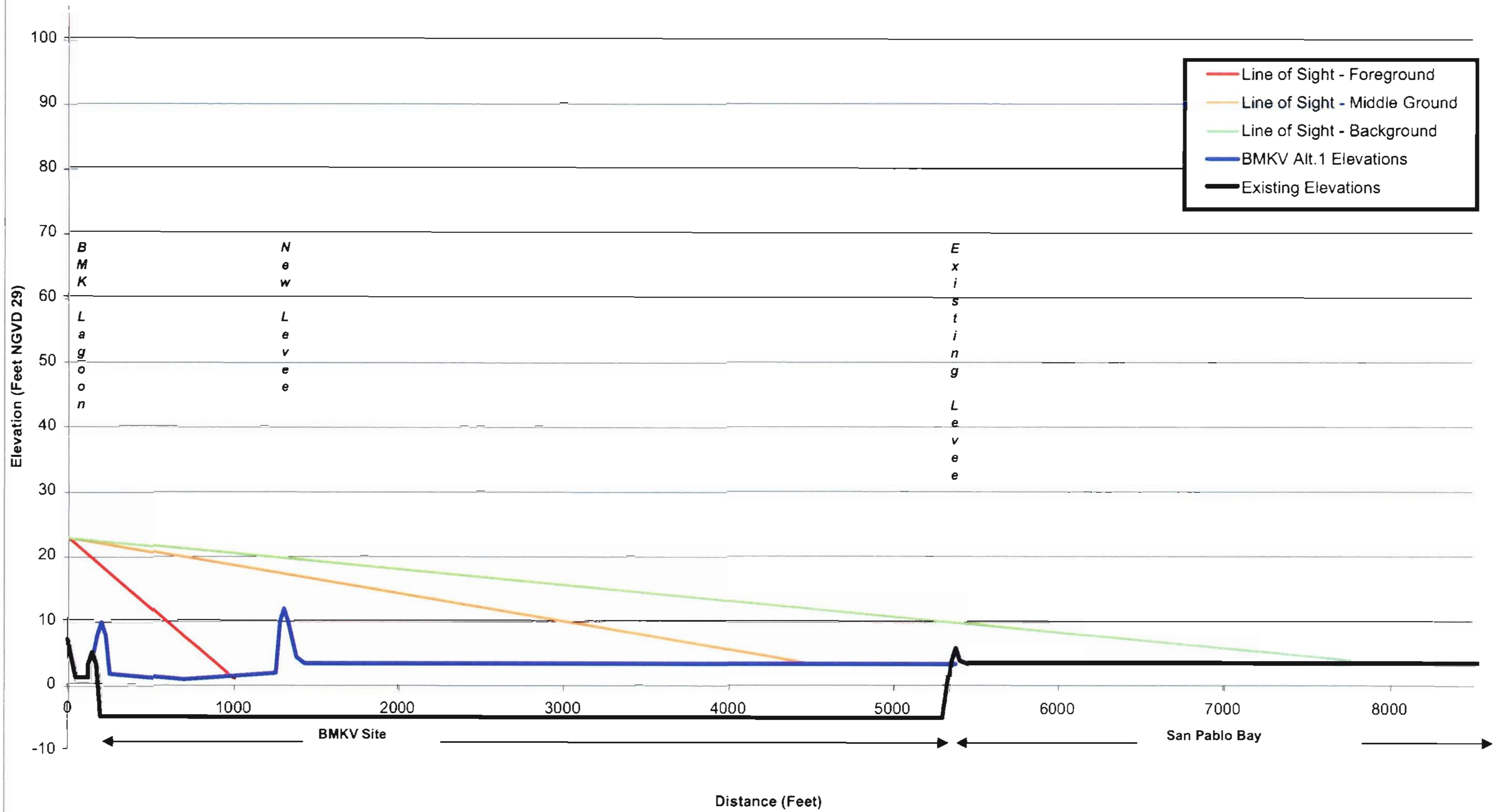
The change in views resulting from building new or improved levees was identified by graphing the line of site from the key viewpoints to features within the restoration site affected by construction of the different alternatives. The profiles generated for viewpoint 2 and 3 are included in this appendix. Separate profiles are generated for street level/ground floor views and for second-story views for each alternative.

Lines of Sight from BMK Viewpoint 2 (Ground Level) - Alternative 1

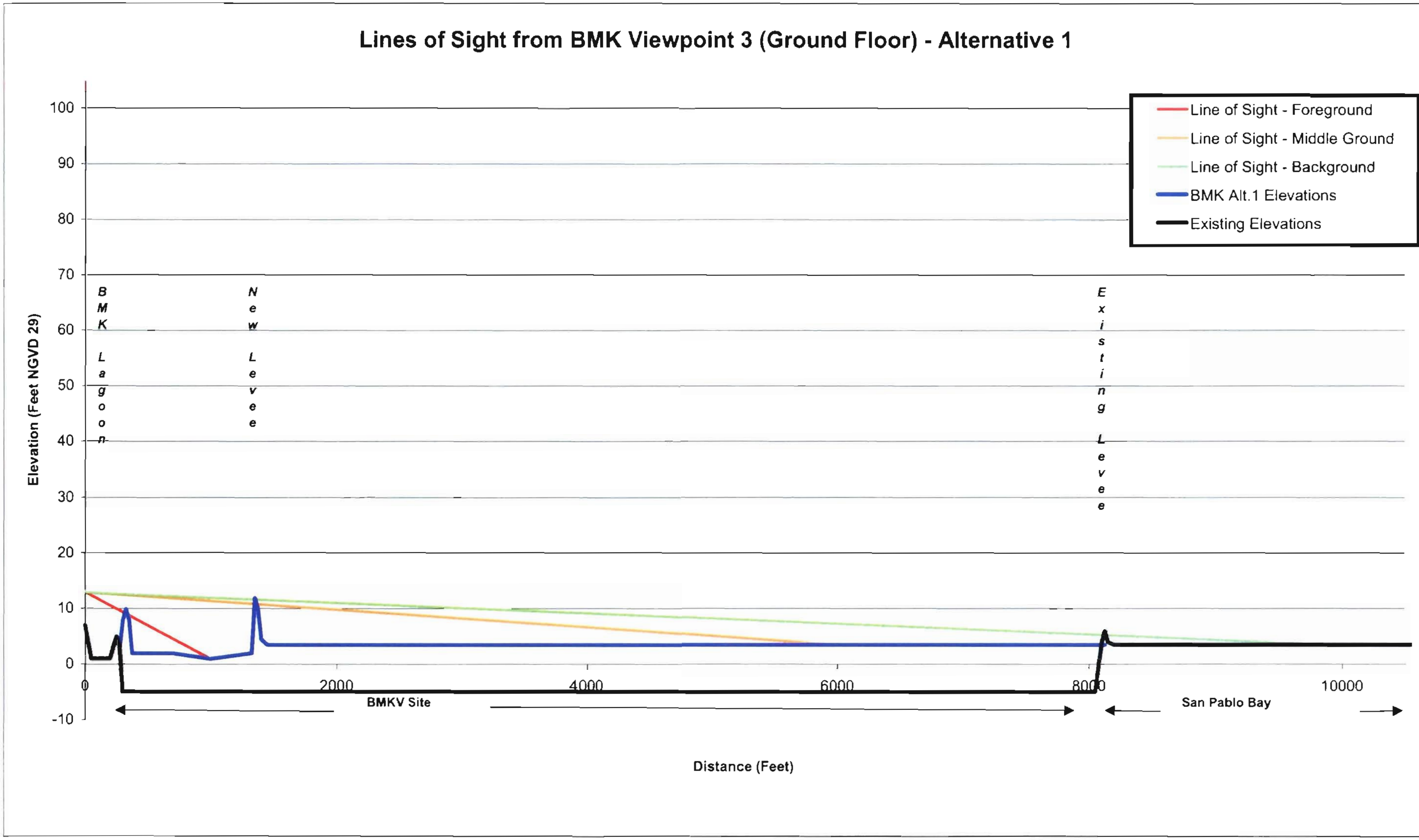


Viewpoint 2 is at E. end of Bahama Reef, view elev assumed to be 13', BMKV elev. based on topographic data; Alt 1 elev based on design elev of 10' (settle to 6') for improved levee S of BMK S lagoon and 12' (settle to 8') for new levee.

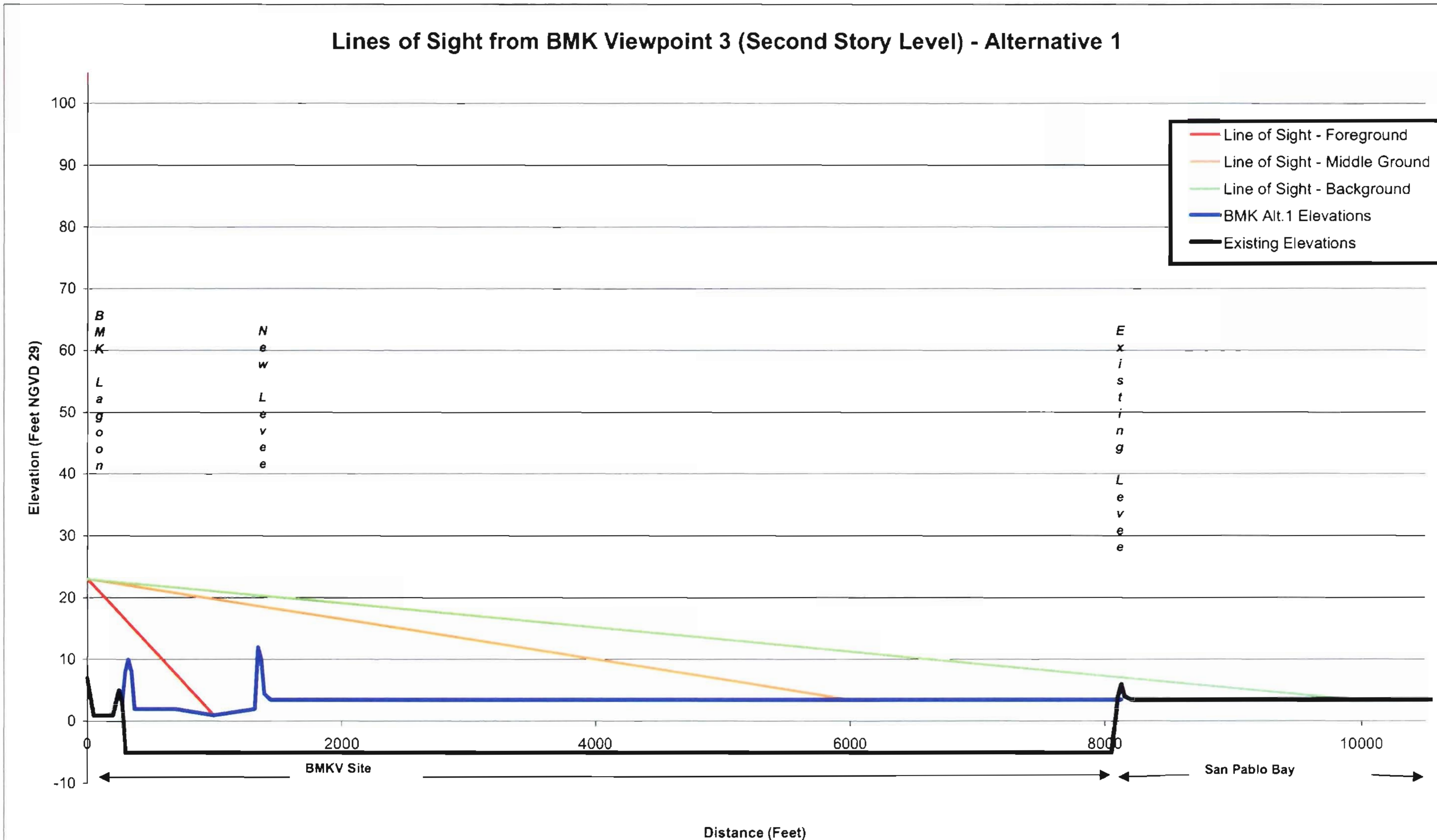
Lines of Sight from BMK Viewpoint 2 (Second Story) - Alternative 1



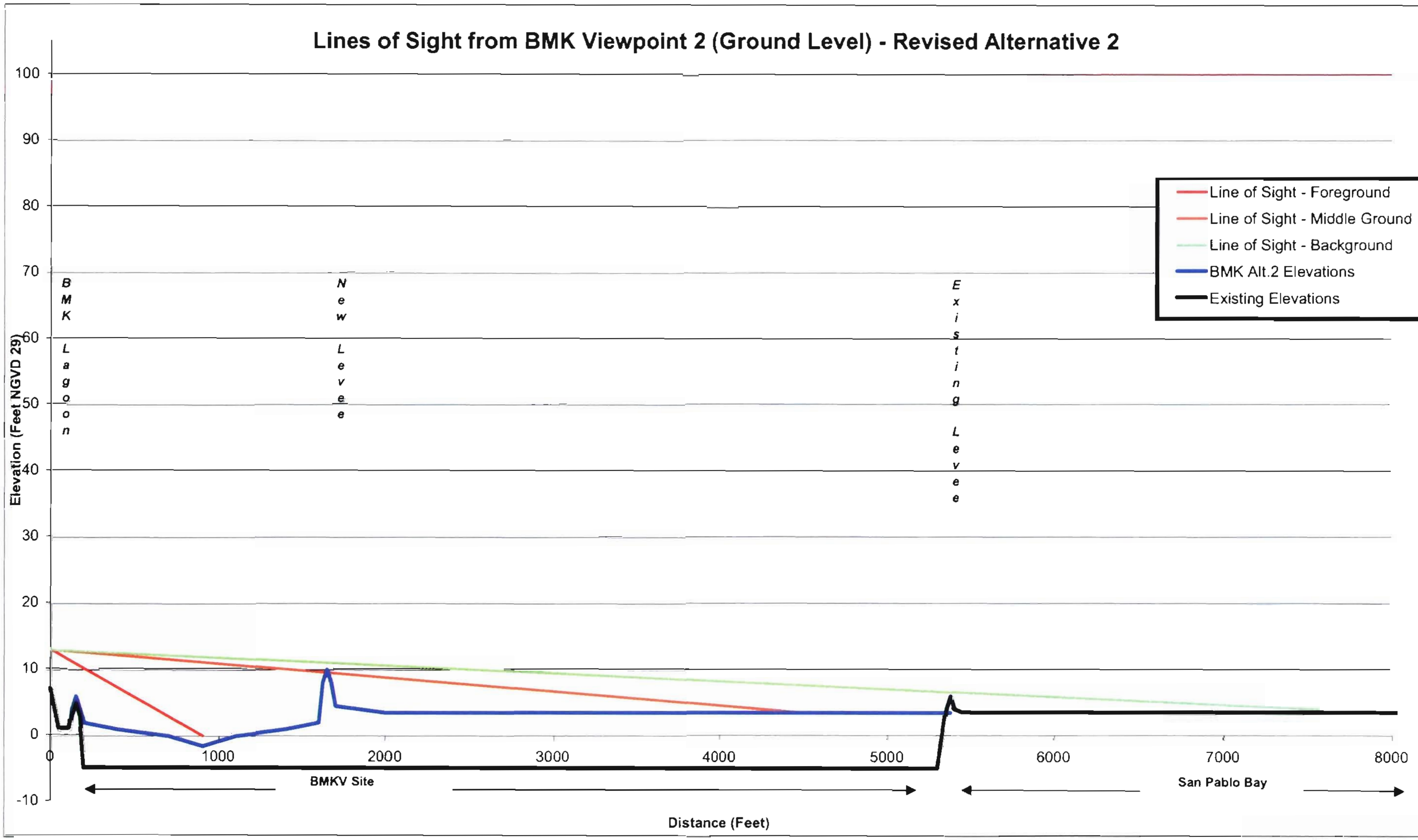
Viewpoint 2 is at E. end of Bahama Reef, view elev. assumed to be 23'; BMKV elev. based on topographic data; Alt 1 elev. based on design elev. of 10' (settle to 6') for improved levee S of BMK S lagoon and 12' (settle to 8') for new levee.



Viewpoint 3 is at SE. end of Del Oro Lagoon, view elev. assumed to be 13', BMKV elev. based on topographic data; Alt 1elev. based on design elev. of 10' (settle to 6') for improved levee S of BMK S lagoon and 12' (settle to 8') for new levee.

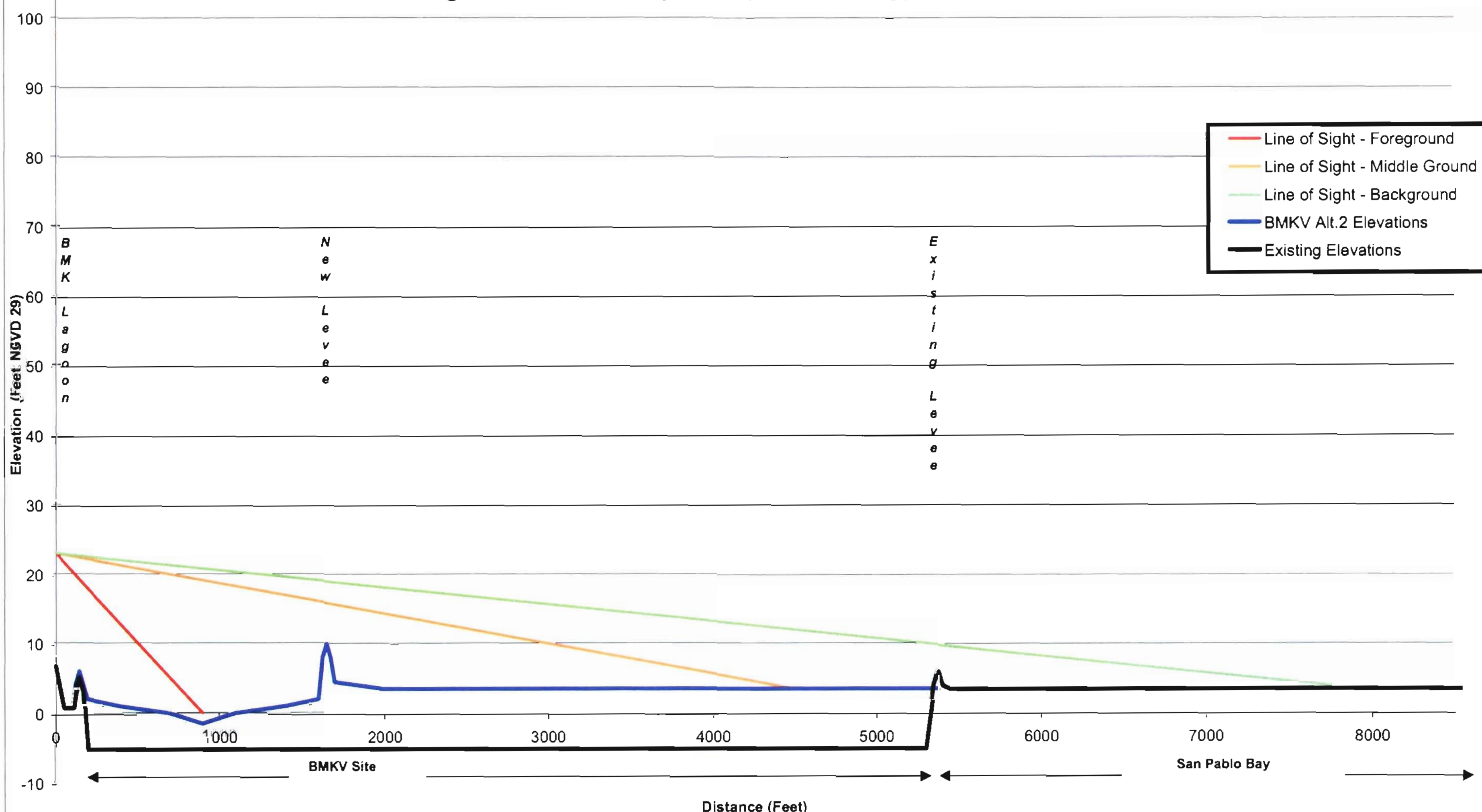


Viewpoint 3 is at SE. end of Del Oro Lagoon, view elev. assumed to be 23'; BMKV elev. based on topographic data; Alt 1 elev. based on design elev. of 10' (settle to 6') for improved levee S of BMK S lagoon and 12' (settle to 8') for new levee.

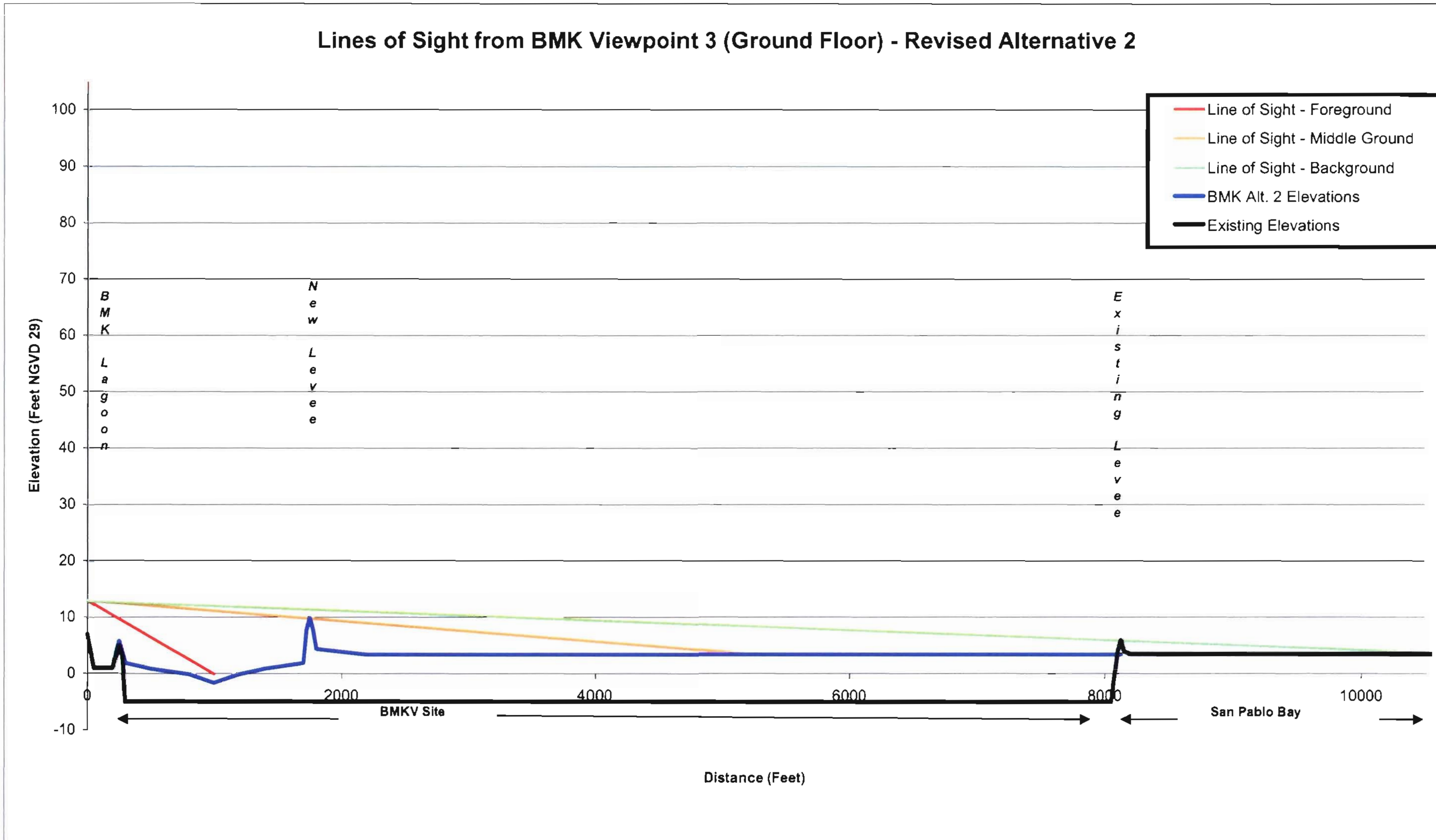


Viewpoint 2 is at E. end of Bahama Reef, view elev. assumed to be 13', BMKV elev. based on topographic data, Alt 2 elev based on design elev. of 6' (settle to 5') for improved S. lagoon levee and 10' (settle to 8') for new levee.

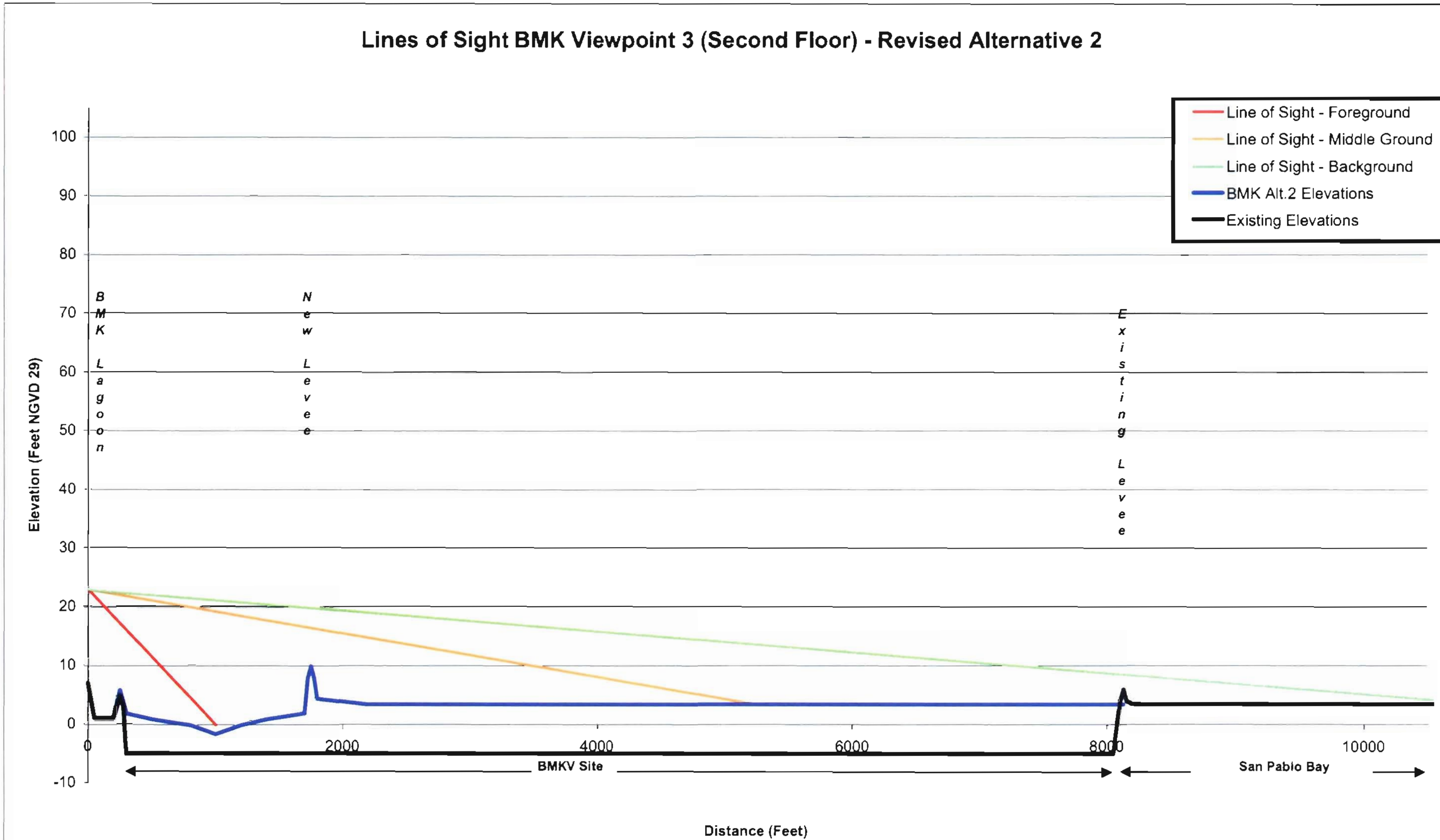
Lines of Sight from BMK Viewpoint 2 (Second Story) - Revised Alternative 2



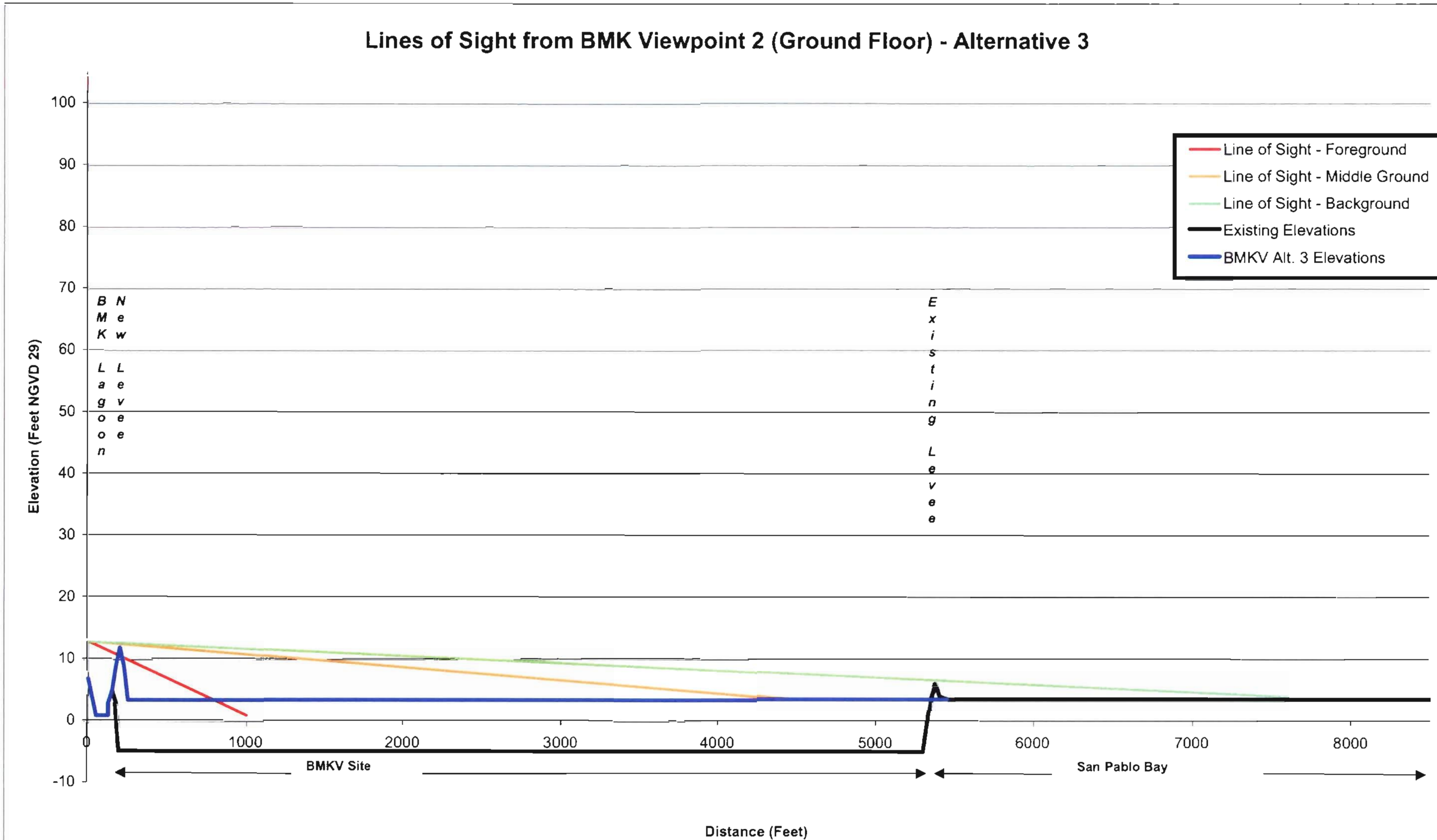
Viewpoint 2 is at E. end of Bahama Reef, view elev. assumed to be 23'; BMKV elev. based on topographic data; Alt 2 elev. based on design elev. of 6' (settle to 5') for improved levee S of BMK S lagoon and 10' (settle to 8') for new levee.



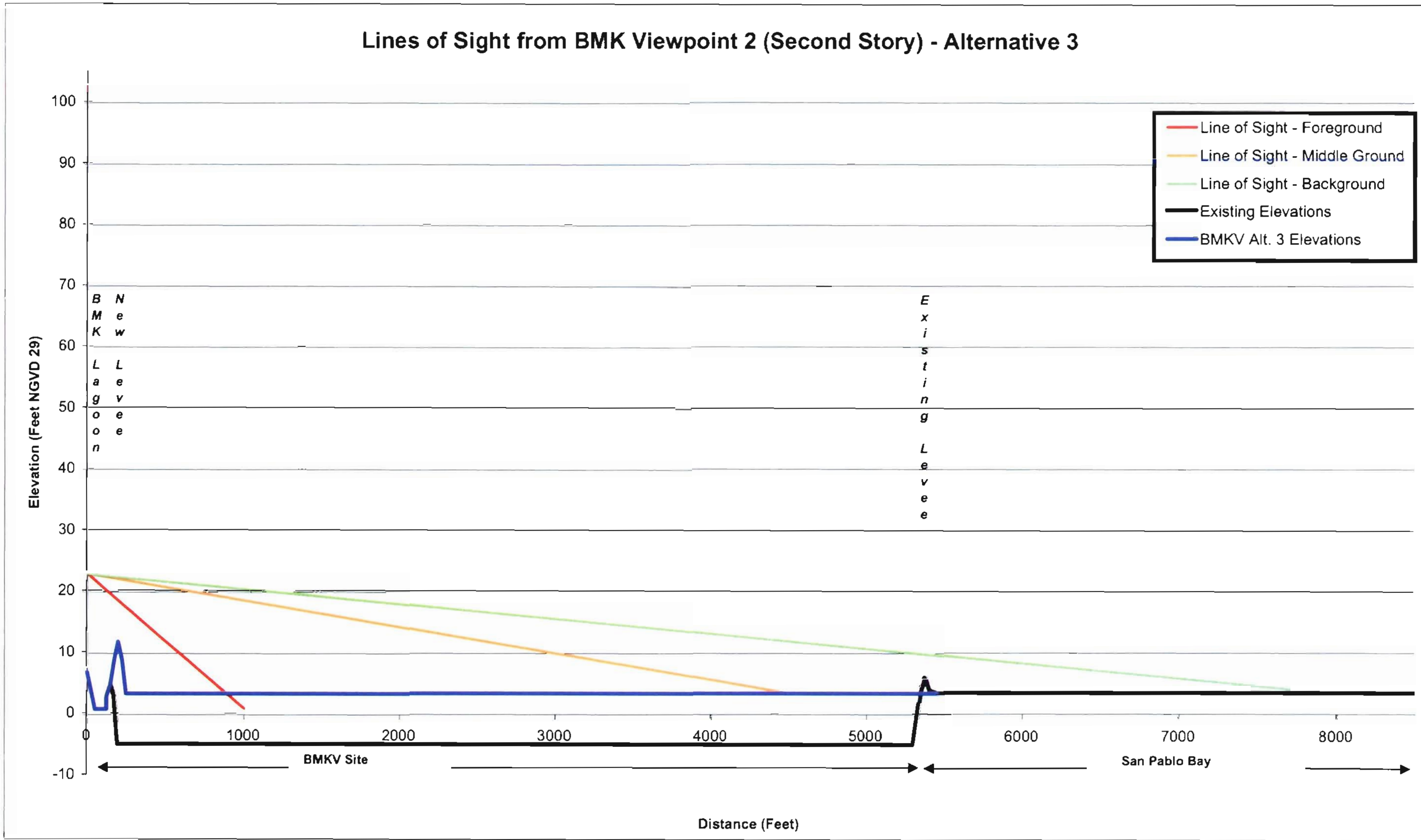
Viewpoint 3 is at SE. end of Del Oro Lagoon, view elev. assumed to be 13'; BMKV elev. based on topographic data; Alt 2. elev. based on design elev. of 6' (settle to 5') for S. lagoon levee and 10' (settle to 8') for new levee.



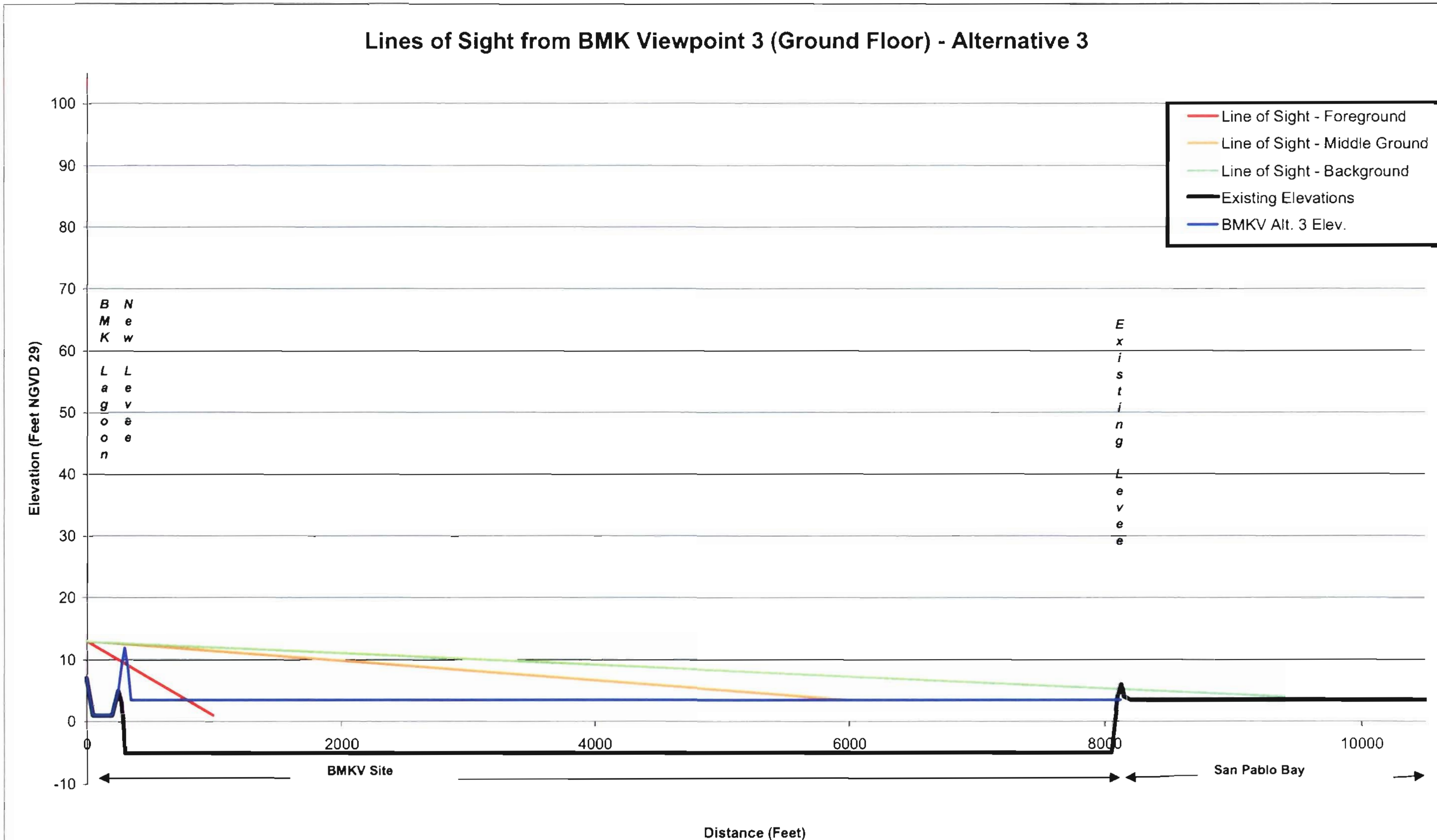
Viewpoint 3 is at SE. end of Del Oro Lagoon, view elev. assumed to be 23'; BMKV elev. based on topographic data; Alt 2 elev. based on design elev. of 6' (settle to 5') for improved levee S of BMK S lagoon and 10' (settle to 8') for new levee.



Viewpoint 2 is at E. end of Bahama Reef, view elev. assumed to be 13'; BMKV elev. based on topographic data; Alt 3 elev. based on design elev. of 12' (settle to 8') for new levee.

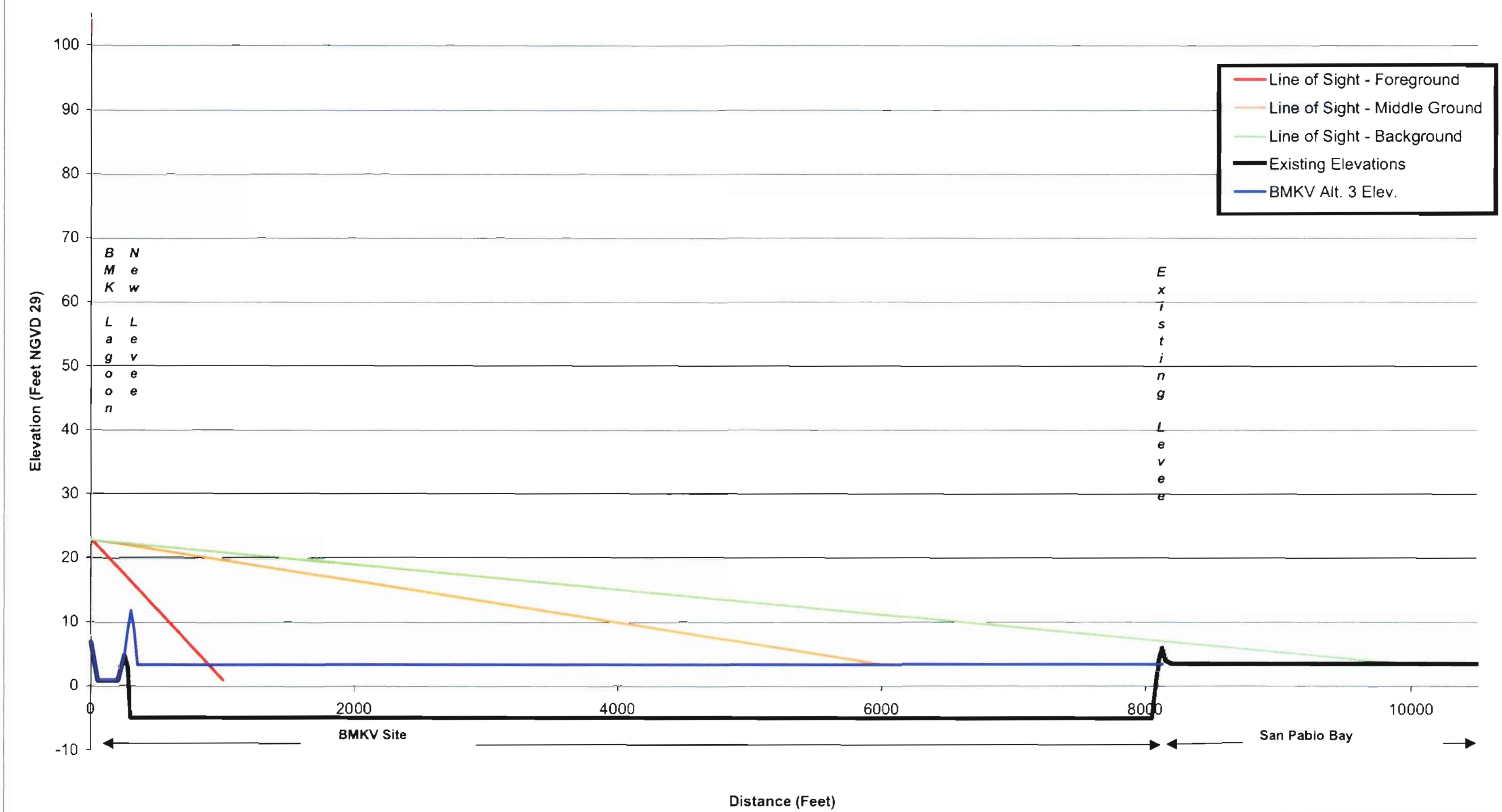


Viewpoint 2 is at E end of Bahama Reef, view elev. assumed to be 23'; BMKV elev. based on topographic data; Alt 3 elev. based on design elev. of 12' (settle to 8') for new levee.



Viewpoint 3 is at SE end of Del Oro Lagoon, view elev. assumed to be 13'; BMKV elev. based on topographic data; Alt 3 elev. based on design elev. of 12' (settle to 8') for new levee.

Lines of Sight from BMK Viewpoint 3 (Second Story) - Alternative 3



Viewpoint 3 is at SE end of Del Oro Lagoon, view elev. assumed to be 23'; BMKV elev. based on topographic data; Alt 3 elev. based on design elev. of 12' (settle to 8') for new levee.

Appendix G

Scoping Report

Jones & Stokes

Memorandum

Date: February 5, 2002

To: Interested Parties

From: Austin McInerny and Kostoula Vallianos, Jones & Stokes

Subject: Bel Marin Keys Unit V Wetland Project NEPA/CEQA Scoping Report

Background

The U.S. Army Corps of Engineers, San Francisco District (Corps), in collaboration with the California Coastal Conservancy (Conservancy) and the San Francisco Bay Conservation and Development Commission (BCDC), are seeking to restore wetlands at the Bel Marin Keys Unit V (BMKV) property as an expansion of the Hamilton Wetland Restoration Project (Hamilton Project) at the Hamilton Army Air Field (HAAF).

The Corps is the lead agency for this project under the National Environmental Policy Act (NEPA). The Conservancy is the lead agency for this project under the California Environmental Quality Act (CEQA). A combined Environmental Impact Report/Statement (EIR/S) was prepared for the Hamilton Project in 1998. A combined Supplemental EIR/S (SEIR/S) will be prepared to comply with the requirements of NEPA and CEQA for inclusion of the Bel Marin Keys Unit V to the Hamilton Project.

The 1,610-acre project area historically supported subtidal bay, tidal wetland, and possibly freshwater marsh habitat, but levees constructed to create agricultural land during the 19th century separated the area from the tidal influence of San Pablo Bay. The land was drained and subsequently the elevation of the land behind the levees subsided to below sea level.

The proposed action is expected to include restoration of the majority of the BMKV parcel to wetlands through, at a minimum, site grading, and breaching of one or more of the existing levees separating the site from San Pablo Bay or other adjacent water bodies, such as Novato Creek. The Corps and the Conservancy are currently developing the Conceptual Wetland Restoration Plan for the BMKV parcel, which will identify the general details of the proposed action and potential alternatives for analysis in the SEIR/S. Alternatives to be considered, at a minimum include a no action alternative, a natural sedimentation alternative, and a dredged material placement alternative.

As part of the NEPA/CEQA review process, the project sponsors sought input from interested federal, state, and local agencies, Native American representatives, and other interested private organizations and parties through publication of a Notice of Intent and Notice of Preparation of the SEIR/S in late November 2001. In addition, a public meeting was held at the Marin Humane Society, Novato, CA on December 5, 2001 from 7 to 9 p.m. to solicit input regarding the issues

of concern to the public and the alternatives that should be discussed in the SEIR/S. The public comment period commenced on November 20, 2001 and closed on December 31, 2001.

This report provides a summary of the comments recorded at the public meeting and the written comments received during the comment period.

Scoping Meeting Summary

On December 5, 2001 approximately twenty-five individuals attended a public scoping meeting that was held at the Marin Humane Society. The meeting provided an opportunity for attendees to visit informally with project staff at a number of informational stations that covered the following topics: preliminary alternatives, project planning/objectives, environmental compliance, and community design issues. The stations included a number of graphics that assisted staff in informing the public about the project. Following the informal discussions, staff provided a brief overview of the project purpose and need, the environmental review process timeline, and a description of a number of draft preliminary project alternatives.

The remainder of the meeting allowed attendees the opportunity to provide oral comments regarding issues of concern and the alternatives that should be discussed in the SEIR/S. Comments covered a wide range of issues and many speakers reiterated points that previous individuals had raised. Thus, we have summarized the comments under a number of specific topical areas, which are detailed below.

Flood Control

- Will the buffer area between BMK homes and the restoration site be sufficient to protect homes?
- South lagoon levee needs to be stronger to prevent flooding of Bel Marin Keys Unit IV homes.
- In past years, severe storms have ruptured the levees and the lagoon has filled up very quickly. What will be done to prevent this in the future?
- More upland area is needed to protect existing Bel Marin Keys homes.
- What amount of active management will be required to maintain flood protection?
- How will lagoons be protected from overflow from the project site during a storm?

Public Access

- Proposed trails are too close to the residential neighborhood to provide homes with adequate security and privacy.

- Would there be public access to the site from Bel Marin Boulevard?
- Where would the public park and have access to the site?
- What are impacts of increased public use of the site, particularly related to crime?
- Providing public access via the Hamilton Wetland project is preferred.
- Consider providing an alternative emergency route for the Bel Marin Keys community. The current road is not adequate and the restoration project could prevent other routes from being developed.
- Would the Bay Trail be connected to the site?
- Consider rerouting the trails. Improving and maximizing the habitat value should be the first priority, then the location of trails should be examined.

Novato Creek

- How will sedimentation amounts and the flow of Novato Creek be affected, if the hydrology of the Novato Creek levee is altered?
- Waterway from Hwy 37 to the bay needs to be analyzed to determine if flows will be sufficient to flush Novato Creek. If Pacheco pond is breached, a flushing mechanism for Novato Creek is reduced.
- Navigational potential on Novato Creek will be impacted regardless of which design is chosen. Though there is a potential to improve navigation by dredging the creek.

Wildlife, Plants, and Insects

- How will mosquitoes be handled?
- What will happen to the animals that currently inhabit the area?

Summary of Letters and E-mails Received During the Comment Period

During the public meeting, and as requested on the published Notice of Intent/Notice of Preparation, the public was also encouraged to mail or e-mail written comments to the project sponsors. Because there were repetitive and interrelated topics presented, the summary of comments and issues raised in the correspondence are grouped by topic area.

Wildlife and Habitat

- Explain how the "no habitat loss goal" will be implemented.

- Identify the specific species for which habitat is being designed, and explain how they will benefit from the restoration of these habitat types. How are migratory shorebirds and waterfowl anticipated to use the site? Show and discuss the vegetative plan for the adjacent upland/transition zone, and discuss how they will meet the habitat requirements for native species.

- Is the proportion of upland habitat on the Bel Marin Keys site the same as for the Hamilton restoration project? Is there a biological basis for the 20% upland goal? Where would seasonal wetlands be located and what type of seasonal wetland would be provided? How large a buffer is planned to separate the habitats from adjacent land uses?

- What measures will be implemented to ensure that upland areas may be used by wildlife?

- How will domestic animals and people be kept away from wetlands and wildlife? Buffers are needed along public access trails. Goals of public access and wildlife/habitat protection may be internally inconsistent.

- How will the invasion of red fox be addressed?

- How will the upland provide habitat for wildlife species displaced by the project?

- Suggest adding additional project goal of maximizing wildlife potential on site.

Hydrology, Project Design, Flood Control

- What are the advantages and disadvantages of hydrologically connecting Novato Creek to the project?

- Further analysis is needed to assess all the impacts associated with hydrologically connecting Pacheco Pond to larger restoration project site.

- What is the reasoning for retaining the levee between Bel Marin Keys project site and Hamilton project site?

- Concerned that there must be an adequate upland buffer zone and substantial levee between the existing community and restoration site.

- Effects of breaching Novato Creek must be analyzed through modeling. Concerns about impact of project on "flushing"of BMK lagoons and Novato Creek.

- Very concerned with issues of flood control, water quality, levee stability, navigation and dredging, particularly related to Novato Creek.

- Maintain the 300-acre ponding easement.

- Suggests alternative with levee 1,500 feet outboard of existing perimeter lagoon levee and/or at mid-1800s shoreline.

- Most important issues for BMK community are water depth for boating, water quality for water sports, and flood control. States 300-acre ponding easement should be retained.

- Suggests that only that portion of the site that was tidal in the mid-1800s be restored to wetlands; proposes that a levee be placed along the shoreline that existed in the mid 1800's as described in the Bel Marin Keys Unit V Final EIR/EIS.

- The potential impacts that may occur on existing waterway and flood control facilities on the project site and in the vicinity must be addressed.

- The ability of inner levees to withstand direct tidal action should be analyzed.

- The impact of upstream water surface elevations on the creeks surrounding the project site should be examined.

- Routing the outfall of Pacheco Pond along its original path should be considered.

- North Marin Water District is concerned about the reliability of water supply to Bel Marin Keys area and suggests consideration of the possible extension of a water transmission pipeline from the Ammo Hill water tank at Hamilton Field in an engineered levee across the BMKV site.

Public Access and Trails

- Strongly support Alternative 1 and 3 because of their consistency with the Bay Trail, local plans, and access to Pacheco Pond.

- Suggest the creation of 2 trails. One (North Levee) would follow existing trail on the levee that separates the Unit V property from Bel Marin Keys South Lagoon. The second trail (Hamilton) would run from the parking lot near Pacheco Pond around the westside of Pacheco Pond and join the existing Hamilton Levee trail.

- Hikers, nature "observers," and bicyclists should have access to the trails. Dogs should be kept on leashes.

- Support limited and controlled public access, but concerned with public intrusion on community.

- Recommendations made in the *Hamilton Public Access Bay Trail Plan* should be addressed as they relate to this project.

- Balancing public access and the creation of wetland habitat needs to be addressed. The following topics should be addressed in the SEIR/S access points, design options, structures to obstruct access, and domestic animals.

Policies and Regulatory Compliance

- The project should incorporate mitigation to comply with the requirements of Marin County Code Chapter 22.95

- The project is subject to two drainage agreements and the Marin County Flood Control and Water Conservation District requests the project comply with the agreements.

- The project is exempt from a grading permit but is subject to applicable requirements of County Code Chapters 23 and 24. This will need to be analyzed in the SEIR/S

- Be sure to address the Marin Countywide Plan polices EQ-2.45, EQ-2.49, A-1.6 and EQ-2.58 related to agricultural conservation, flood basin use, and the preparation of an environmental assessment.

Dredged Material

- The Marin County Department of Public Works requests that provisions be made into the project to allow for the disposal of dredge material on an ongoing basis.

- Dredge material from Novato Creek is offered to the Coastal Conservancy in the construction of this project.

- What is expected source and quality of dredge material?

- What are the plans for future and permanent management and ownership of the site?

Other Comments

- How can construction at Hamilton proceed without an approved plan for BMKV?

- Concern about potential for relocated Novato Sanitation District outfall closer to mouth of Novato Creek.

(1)

Post-it® Fax Note 7671 | Date 12/21/01 | # of pages ▶ 3
To Rich Walter | From Gandesbery
Co./Dept. JSA | Co.
Phone # | Phone # 286-7028
Fax # 433-8961 | Fax #

Marin Audubon Society *Box 59*

December 19, 2001

Tom Gandesbery
State Coastal Conservancy
1330 Broadway, 11th Floor
Oakland, CA 94612

Eric Jolliffe
US Army Corps of Engineers, SF District
333 Market Street, 8th Floor
San Francisco, CA 94105

RE: SCOPING FOR BEL MARIN KEYS UNIT 5

Dear Mr. Jolliffe and Mr. Gandesbery:

The Marin Audubon Society appreciates the opportunity to submit the following scoping comments for the Bel Marin Keys Wetland Restoration Project Supplemental Environmental Impact Report/Statement to the Hamilton Restoration Project EIR/S. We have a long time interest in these parcels having participated in surveys of Hamilton for the USFWS Diked Bayland Survey over a 5 year period and we have opposed development of the BMKV site for 15 years. These large sites are critical and central to restoration of the once extensive tidal marsh system in this important part of the Bay and to the survival of endangered and migratory species that depend on the Bay. For these reasons, we are committed in ensuring that the most effective and beneficial restoration project is designed and constructed on the BMKV site.

The restoration should be designed to replicate, to the extent possible, the historic wetland system, and to ensure that the habitat remains viable to sustain the wildlife it is intended to provide for. In order to implement the project objective "to create and maintain wetland habitats that sustain viable wildlife populations and in particular Bay Area special-status species" the project will need to include the mix of tidal and seasonal wetlands and upland habitats, and locate public access so as to degrade, not intrude into or limit wildlife use of the habitats in any way.

We request that the following issues and questions be addressed in the environmental document:

- The anticipated ownership and management of the site should be discussed. Does the the Conservancy anticipate managing the site for 20 years? Is no federal or state agency willing to take over management before that, even if the construction and initial operation proceed as planned? If not, why? How will the decision on a permanent owner be made?

- Explain how the construction of Hamilton can proceed without an approved plan for BMKV now that inclusion of BMKV is certain?

- One of the stated project objectives is "to ensure no net loss of wetland habitat presently at the BMKV and HAAF sites"? Describe what habitat types are on these sites at present and how it will be assured that no loss of habitat will occur even though most of the diked bayland/seasonal wetland habitat will be returned to tidal action?

- Identify the specific species for which habitat is being designed. What habitat types

do these species need to perform essential life cycle functions. Discuss how the restoration will provide these habitat types. How are migratory shorebirds and waterfowl anticipated to use the site? Discuss how the restoration will provide habitat for Black Rail, Salt Marsh Yellowthroat and San Pablo Song Sparrow?

- Adjacent uplands are an essential component of tidal wetland habitats. They provide refugia habitat for endangered species, nesting habitat for waterfowl, movement corridors, foraging and resting habitat for other bird and mammal species. Is the proportion of upland habitat the same as for the Hamilton restoration? Is there a biological basis for the 20% upland?

- Show and discuss the vegetative plan for the adjacent uplands/transition zone, and discuss how they will meet the habitat requirements for native species.

- Where would seasonal wetlands be located and what type of seasonal wetland would be provided? Describe how high tide roost habitat for shorebirds will be provided.

- Much of the area originally designated as upland on the Hamilton Plan was eventually modified to be some type of seasonal wetland habitat. How will be assured that the uplands will remain uplands and that areas of seasonal wetlands are provided in addition to the uplands?

- In addition to transition zone/refugia habitat, an area of upland is needed to buffer the wildlife using the habitats from adjacent uses, particularly the impacts of people and domestic animals using public access trails. What is the size of the area provided to buffer the habitats, both wetland and adjacent uplands, from these adjacent uses?

- What measures will ensure the wildlife can use the upland for nesting and resting etc? What distance does the SF Habitat Goals Report recommend for buffer areas to protect endangered species and to provide for other species? What vegetation will be planted?

- What other measures (fencing, planting, etc.) will be used to keep people and domestic animals away from the wetlands and wildlife?

- The goal calling for "...public access that is compatible with protection of resource values and regional local public access policies" may be internally inconsistent and therefore impossible to implement. Local public access policies, at least as expressed by some people, are not compatible with protecting wildlife and habitat because the access would intrude into or come too close to the habitats. Because the purpose of the project is to restore habitat, and the funding was provided for this purpose, the habitat functions must take precedent over the desires of some members of the public to be at a distance from the habitat that would cause disturbance and adverse impacts to wildlife.

- We question the project objective that buffers be included "...particularly adjacent to residential areas, so that wildlife will not be impacted by adjacent land uses." While we agree that buffers area needed adjacent to residential areas, they are also critically needed along public access trails where people and dogs could go off trails and into the habitats.

- Address how the potential for erosion of levees and upland edges will be controlled or eliminated? How will potential erosion from wave fetch be addressed?

- How will the potential for invasion by red fox be addressed?

- What is the anticipated source of the dredged material? Discuss the quality of the dredged material and how it will be assured the material is clean enough for wetland habitat?

- What wildlife species would be displaced by the restoration project? Explain how the upland habitat design will provide for these species.

- What are the advantages/disadvantages of hydrologically connecting to Novato Creek? Would a connection or removal of the levee be more or less likely to contribute to the scouring of Novato Creek?

- We have major problems with establishing a hydrologic connection linking the restoration with Pacheco Pond because of the significant impacts to the habitat functions and values provided by Pacheco Pond. Connecting to this habitat would extend tidal marsh and result in the loss of the current habitat. Pacheco Pond habitat would not be provided by a restored tidal but is complimentary to tidal marsh habitat. Furthermore, it was created as mitigation for loss of shallow riparian habitat which was destroyed by construction of the Ignacio Business Park. As reflected in the surveys we conducted for the USFWS Diked Bayland Study, the brackish-fresh pond waters are well used by diving birds, shorebirds and other migratory species. Introducing tidal waters to this pond would also impact riparian habitat and fresh water marsh habitats for some unknown distance extending along Pacheco Creek to the Humane Society. For further consideration of this alternative, a thorough analysis of potential impacts should be required. This must include a recent survey of wildlife use during all seasons and a hydrologic analysis of upstream impacts, how far the salt water would extend resulting in habitat modifications would extend, should be conducted.

- An alternative using treated wastewater is being considered. We have several problems with such an alternative: the potential extent of the management that would be required and the impact of creating an unnatural habitat type that never existed in this area. What are the envisioned benefits for wildlife of such a system, and the potential adverse impacts and costs? It would appear to remove habitat for native endangered species. Discuss the potential management problems such as how would the growth of aquatic vegetation be controlled?

- Why is retaining the levee between BMKV and Hamilton being considered? How else would the BMKV restoration be connected with the Hamilton restoration than by breaching or eliminating the levee between the two sites. Retaining a levee between the two would have several potential adverse impacts including fragmentation of marsh habitats, pathway for red fox and other non-native animals into the marsh habitat, pathway for people.

Thank you for responding to our questions.

Sincerely,

Barbara Salzman
Conservation Committee

2

Bel Marin Keys **Community Services District**

December 20, 2001

Tom Gandesbery, California State Coastal Conservancy
1330 Broadway, 11th Floor, Oakland, CA 94612

Eric Jolliffe, U.S. Army Corps of Engineers, S.F. District
333 Market Street, 8th Floor, San Francisco, CA 94105

Gentlemen:

We have received the Notice of Intent / Notice of Preparation of supplemental NEPA / CEQA documentation for the Bel Marin Keys Unit 5 Wetland Restoration Project. We appreciate the opportunity to comment on the project's goals and objectives, as well as the alternative restoration approaches and environmental issues of concern identified in the NOI / NOP. Our comments are also based on the presentation and discussion at the Public Scoping Meeting of 5 December 2001.

Through the efforts of our Planning Advisory Board and its Baylands Management Committee, Bel Marin Keys (BMK) has actively participated with the California State Coastal Conservancy (SCC) and its consultants, the Bay Conservation and Development Commission (BCDC) and the U.S.Army Corps of Engineers (COE), in developing many of the project's objectives and identifying issues of concern. Responsible planning and execution, enhanced through short and long term management plans which integrate the needs of BMK and neighboring stakeholders, are key to the success of this project.

The BMK Planning Advisory Board (PAB) and Community Services District (CSD) endorse the Project Goal and its stated Objectives. In particular, we support the beneficial use of dredge spoils to realize this intent, and hope that our community can work together with the COE and SCC in this process by providing dredge material through our current and future dredging projects. Comments and concerns pertaining to the other Project Objectives are as follows:

* As a residential waterfront community directly adjacent to the project development, BMK has concerns that there be an adequate upland buffer zone between our community and the restoration habitat created for threatened and endangered species, as well as substantial and appropriately located levees for the protection of the infrastructure, flood control and maintenance of the community. The Restoration Project site's potential inclusion in a proposed Marin Baylands Wildlife Refuge increases the need for adequate upland buffer separation between the properties..

We support the objective of limited and controlled public access to the project site, and believe that it offers significant opportunities for public education and recreation. Due to BMK's proximity to the upland portion of

4 MONTEGO KEY NOVATO CALIFORNIA 94949 415-883-4222 FAX 415-883-3683

the site, however, we are concerned about the possibility of public intrusion into our property. We request that consideration of public access be studied and assessed as to its impacts on the BMK community, as well as on the wildlife habitat.

The three Alternative Restoration Approaches given in the NOI / NOP appear reasonable for purposes of comparitive analysis. It is important to note, however, that any connection of the project site to Novato Creek or Pacheco Pond through breaches in the existing levees or culverts, will have substantial implications for the maintenance and security of our community.

* Breaching the south levee, or other alterations to Novato Creek, would radically alter its hydrology. The Creek is used for boating / navigation as well as flood control and flushing of the BMK lagoons to maintain water quality. The effects of this action must be determined through conduct of hydrologic studies of the lower reaches of the Creek, and 3D modelling from a number of perspectives which assess all possible impacts to the Creek's watershed, and the probabilities of their occurrence.

We concur with the Environmental Issues of Concern stated in the NOI / NOP. While being sensitive to the issues involving adequate diversity of wildlife and enhancement of endangered species habitat, we in BMK are equally concerned with the issues of flood protection, water quality, levee stability, and navigation and dredging. We request that the environmental documentation address and provide solutions for all impacts of the project design, including the following specific issues:

* Flood control for BMK involves maintaining protection from tidal action in San Pablo Bay and overflow from Novato Creek, and providing a reliable means of discharging flood waters from our lagoons to an adjacent holding basin during winter storms which are concurrent with high tides. A 300 acre ponding easement which has been dedicated on the BMK 5 site must be maintained for our exclusive use in any future development. Discharge from the lagoons must be accomplished through installation of engineered culverts and / or spillways. Pumping is not an acceptable alternative, and does not satisfy the Project Objective of "...little active management."

* The water quality in BMK lagoons and Novato Creek is dependent on many factors including the proportion of fresh to salt water, water temperature, silt content, concentration of pollutants, and our ability to thoroughly flush the lagoons. Flushing is currently inhibited, however, by the buildup of sediments in Novato Creek, particularly near Marker 25.

* Through two navigational locks, all properties in BMK have direct water access to San Pablo Bay via Novato creek, and continuous navigational access is critical to the sustained economic viability of the community. As noted above, any proposed construction resulting in changes to the Creek,s hydrology must be studied thoroughly in the NEPA / CEQA documents and mitigated through the project design. We note that one of the proposed relocation routes for the Novato Sanitary District's outfall pipeline would discharge treated effluent near the mouth of Novato Creek. This option should be carefully studied for its potential impacts on the hydrology and water quality in the area, including upstream effects.

The three preliminary Project Design Alternatives reviewed at the Public Scoping Meeting on 5 December were very similar in most respects and, as stated at the meeting, will require further development. There were several community concerns expressed there which, we believe, warrant further review and modification of the designs presented.

* To provide the desired upland buffer zone separating human and wildlife / endangered species habitat, as well as maintain the required 300 acre flood ponding area, we propose construction of a separate new levee to contain San Pablo Bay. It would be located approximately 1,500 feet outboard of the existing perimeter lagoon levee, as shown on Figure 1, attached. If it is also desired to accommodate the overflow from Pacheco Pond during high water events, the new levee could be constructed along the "Mid-1800s" shoreline shown on Figure 1. Modelling would be required to determine if this approach would result in a negative impact on the BMK ponding area.

* This concept would improve the alternative plans' compliance with local agency regulations and policies, facilitate flood control for the City of Novato, enhance diversity of wildlife habitat, preserve and expand existing fresh water seasonal wetlands, provide a wetland area equivalent to that of the mid-1800s, and mitigate some of the BMK concerns noted in the foregoing paragraphs.

Due to the size, complexity and extended time frame needed to accomplish the Restoration Project, we request that a long term assessment program, including a comprehensive environmental / biological monitoring plan, be developed. This plan should involve the detailed monitoring of water quality and hydrology for the areas and waters impacted by the project.

Lastly, we understand that the selected Restoration Plan will be analyzed in the SEIS / SEIR for compliance with applicable portions of the Marin Countywide Plan (CWP), as well as the applicable policies of other concerned jurisdictions, such as the BCDC and the City of Novato. We also understand that the NEPA / CEQA effort will include a review of previous environmental documentation prepared for the site, including the earlier Environmental Assessment (EA) of the site and the EIR / EIS for BMK Unit 5. We request that, per CWP Policy EQ-2.49, should the EA require updating due to its age, BMK be permitted to review the document.

Thank you again for the opportunity to participate in the planning for this unique and exciting project.

Sincerely,

Shirley Graves   R.W. Forsyth

Shirley Graves, President — Bel Marin Keys Board of Directors

Robert Forsyth, Chairman — Bel Marin Keys Planning Advisory Board

Attachment - Figure 1

Copy to: Marin County Board of Supervisors
Marin County Planning Commission
Bay Conservation and Development Commission

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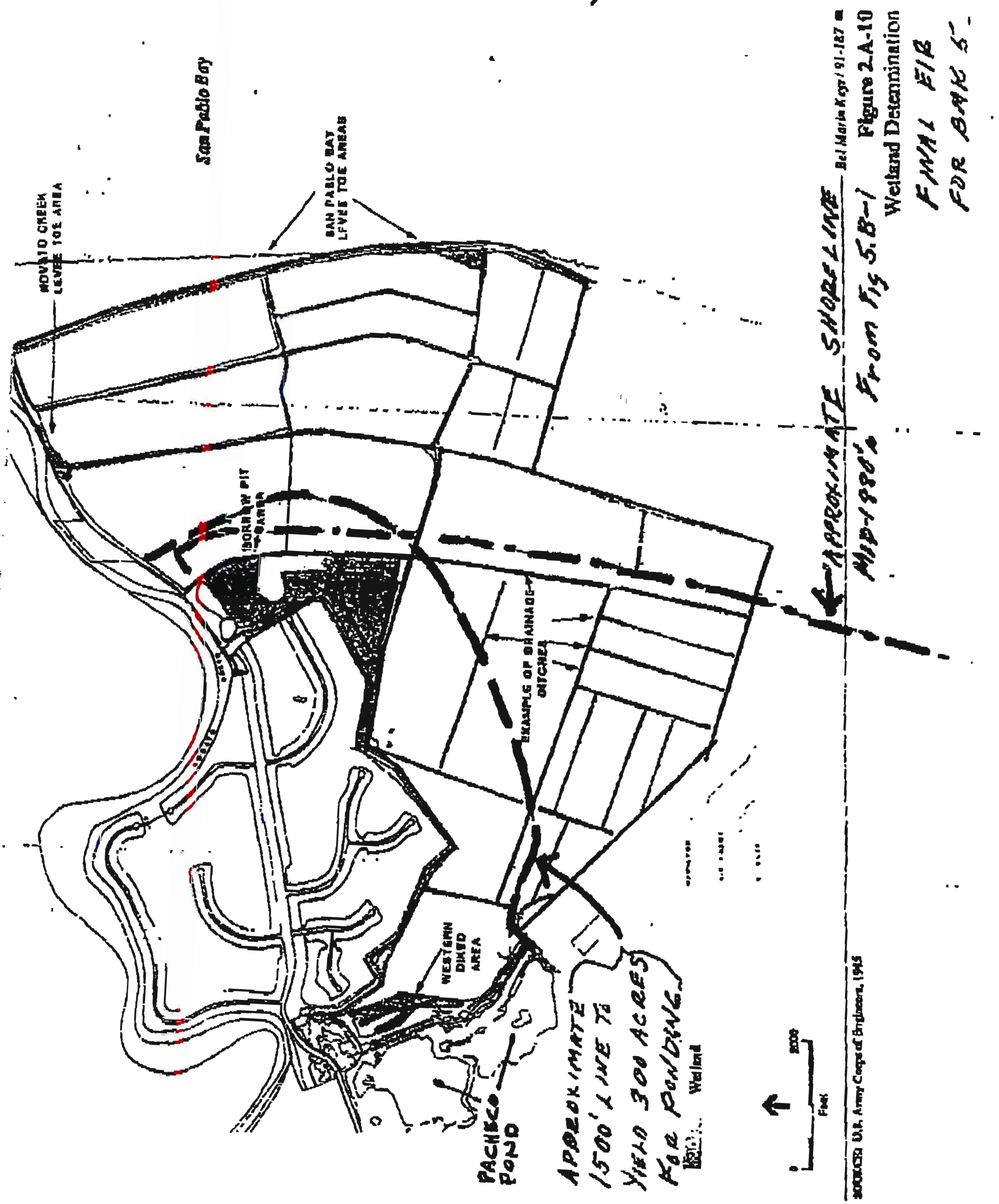
OAKLAND, CALIF.

JUL-09-2002 16:26 FROM:JONES-AND STOKES OAK 5104338961 TO:17752018228 P.007/018

JAN 02 '02 10:21AM COASTAL CONSERVANCY P.3/3

FIGURE 1



3

ROBERT A. FARNHAM
11 DOLPHIN ISLE
BEL MARIN KEYS, CA 94949-5391 TEL/FAX 415-883-2328

December 18, 2001

TOM GANDESBERY
CALIFORNIA COASTAL CONSERVANCY
1330 BROADWAY, 11th FLOOR
OAKLAND, CA 94612-2530

ERIC JOLLIFFE
U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT
333 MARKET ST., 8th FLOOR
SAN FRANCISCO, CA 94105

Gentlemen:

Thank you for the opportunity to respond to the NOI/NOP for the Bel Marin Keys (BMK) Unit 5 Restoration Project. I also want to thank you and express my appreciation for the open-and cooperative Scoping Meeting on December 5, 2001.

I am in agreement with the goals as stated in the NOI/NOP, but as I stated in the meeting, there should be an additional goal to maximize the wildlife habitat potential of the site.

Since the meeting I have had time to review the Marin Countywide Plan (CWP) and the Final BMK UNIT 5 EIR/EIS (FEIR/EIS). There are several relevant CWP Policies that must be addressed.

FIRST, UNDER "LAND USE IN THE BAY FRONT CONSEVATION ZONE".

POLICY EQ-2.45 GRANTS AGRICULTURE USE AND FLOOD BASIN (USE) EQUAL STATUS WITH RESTORATION TO TIDAL STATUS.

POLICY EQ-2.49, MANDATES PREPARATION OF AN ENVIRONMENTAL ASSESSMENT (EA) PRIOR TO DEVELOPMENT. THE EA BECOMES PART OF THE EIR.

SECOND, UNDER "AGRICULTURAL LANDS IN THE BAYFRONT CONSERVATION ZONE" (BFC).

POLICY A-1.6, STATES, "RECOGMIZING THAT AGRICULTURE LAND IS A NON-RENEWABLE RESOURCE, THE COUNTY WILL, TO THE EXTENT FEASIBLE AND LEGAL, PRESERVE PRODUCTIVE AGRICULTURE LAND IN THE BFC IN THE CITY-CENTERED CORRIDOR.

POLICY EQ-2.58 STATES, "THE COUNTY SHALL PROTECT EXISTING AGRICULTURE LANDS IN THE BFC", AND LISTS REASONS FOR THEIR IMPORTANCE.

Probably the most important issues for the BMK community involve water. Water depth for boating, water quality for water sports and water containment and release to prevent flooding.

I will only address the water release concerns since they must, and can, be solved by retaining land now in agriculture. County Flood Control Regulations for F-2 Zones (most of the Unit 5 site) require retaining 3 acres of ponding for each acre developed.

When Unit 4 was developed, a 300-acre ponding easement was recorded on the Unit 5 site. During winter storms concurrent with high tides, BMK can not release flood water to the creek. Water is released through a culvert to the Unit 5 site. The 300-acre ponding must be retained for BMK exclusive use under any future project plan.

In addition to the above restriction, the regulations will only permit restoring about 320 acres of the remainder of the site to tidal wetlands without flood control improvements.

It was agreed at the scoping meeting that modifications of the alternative designs may be necessary and would be considered. I would propose that only that portion of the site that was tidal in the Mid-1800's be restored to wetlands.

The attached Figure 1 is from the FEIR/EIS. On this Figure there are two dashed lines. One line shows the location of a new levee that would provide BMK with the 300-Acre ponding area. The second line shows the location of a new levee located along the shoreline that existed in the mid-1800's. The location of this line is shown on Figure 5.B-1 of the FEIR/EIS.

Placing the levee at the shoreline location would:

1. Provide the BMK 300-acres ponding requirement plus adequate ponding for Pacheco Pond overflow during highwater events. This would need to be confirmed.
2. Preserve existing fresh-water marsh in the borrow pit area.
3. Relieve enough flood water from the creek via Pacheco Pond overflow to satisfy the Flood Control Regulations to release the additional Unit 5 site area necessary for tidal restoration up to the mid-1800's shoreline.
4. Allow economic agriculture in the summer (see Policy A-6, Consistency Analysis, pg 4.16 of FEIR/EIS.) to satisfy the CWP. (A-1.6 & EQ-2.58)
5. Provide an expanded diversity of habitat to satisfy the CWP. (EQ-2.58)
6. Provide flood control for the City of Novato.
7. Provide agriculture to meet BCDC Policy 1, pg 6 and Policy 2, pg 4 of BCDC Diked Historic Baylands of S.F. Bay.
8. Provide wetlands area equivalent to the mid-1800's.

This proposed design should be used as a sub-case of the Alternative Restoration Approaches - Restoration of Wetlands Using Dredge Material.

Thank you again for your cooperation.

Sincerely yours,

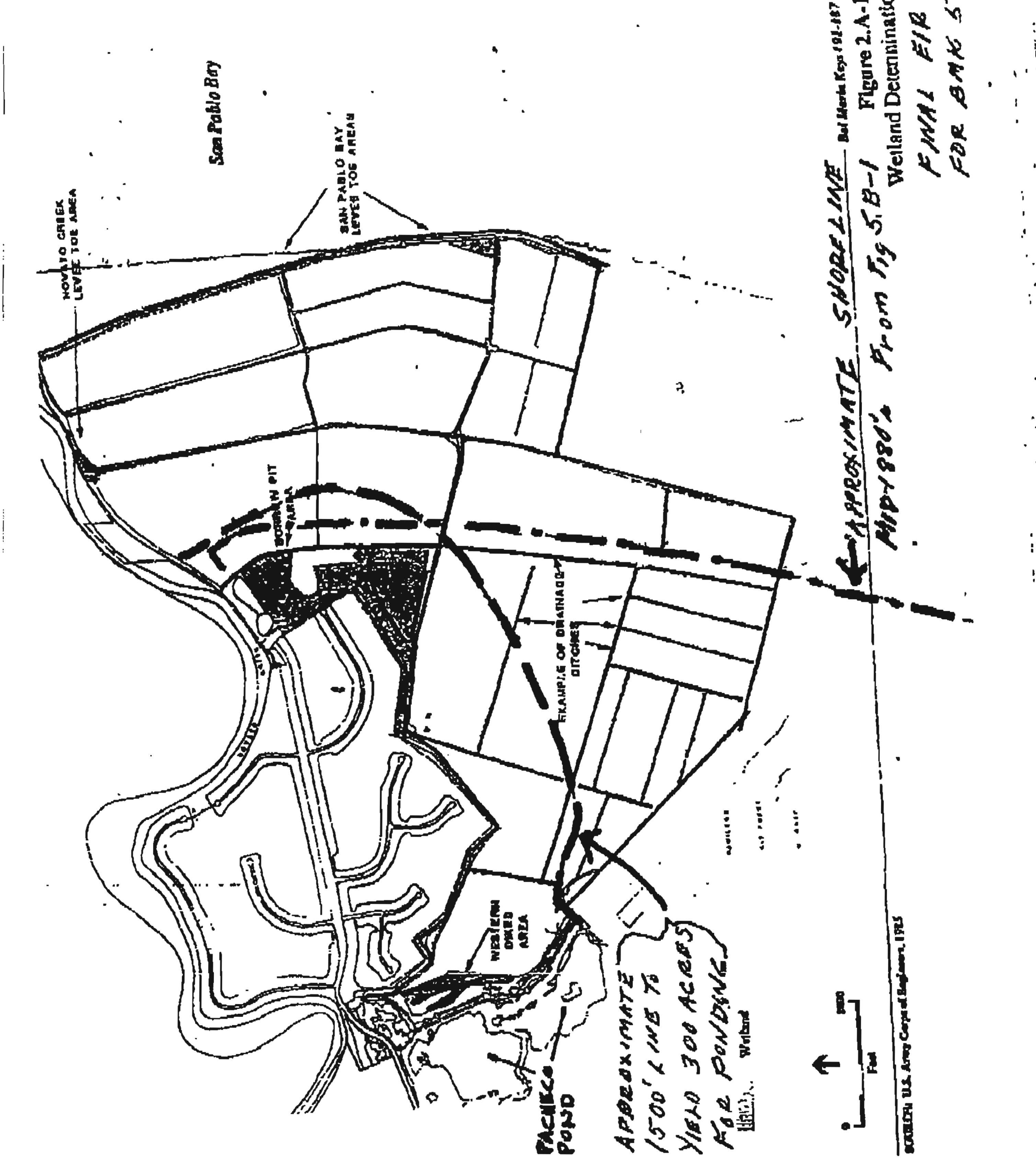
RA Farnham

Robert A. Farnham

attached: Figure 1.

cc: Marin County Board of Supervisors
Marin County Community Development Department
Marin County Public Works Department

FIGURE 1.



Bel Marin Keys 191-187
Figure 2.A-10
Wetland Determination

SOURCE: U.S. Army Corps of Engineers, 1985

4

From: "Laura Thompson" <LauraT@abag.ca.gov>
To: <belmarinkeys@jsanet.com>
Date: Fri, Dec 28, 2001 3:16 PM
Subject: Bel Marin Keys Unit V / Conceptual Plan Comments

Bel Marin Keys Project Team:

I am writing to submit comments on behalf of the San Francisco Bay Trail Project for the conceptual Bel Marin Keys Unit V Plan presented to the public on December 5, 2001. The Bay Trail Project is a nonprofit organization administered by the Association of Bay Area Governments (ABAG) that plans, promotes and advocates for implementation of a continuous multi-use trail along the perimeter of San Francisco and San Pablo Bays.

At the public meeting, three conceptual plans were presented. All plans showed northern extension of the Bay Trail from the existing Hamilton levee.

The Bay Trail Project is pleased to see these trail alignment alternatives incorporated into the early design stages of the project. We are in strong support of Alternative #1 (trail along the eastern edge of an expanded Pacheco Pond and a spur alignment extending east along the new levee) and Alternative #3 (trail along the eastern edge of an expanded Pacheco Pond) for the following reasons:

(1) This alignment is similar to the current adopted alignment shown in the Bay Trail Plan (1989) and the City of Novato's General Plan providing continuous trail and shoreline access through the City of Novato.

(2) The alignment is consistent with the overall wetland restoration project objective of providing public access that meets the needs of regional and local plans.

(3) Extending the trail along the eastern edge of Pacheco Pond is preferable to the route along the western edge of Pacheco Pond. The eastern route incorporated as part of the restoration project will provide trail users with a natural experience and an opportunity to enjoy the publicly-funded wetland restoration project.

(4) The project site, combined with the Hamilton Airfield restoration, allows for even greater acreage of upland habitats, thus providing a better environment for wetland species and more opportunities to incorporate public access into the project without impacting sensitive species.

Thank you for the opportunity to comment on this expanded wetland restoration project. We look forward to continued participation in the planning process.

Laura Thompson
Bay Trail Planner
Association of Bay Area Governments
P.O. Box 2050
Oakland, CA 94604-2050
(510) 464-7909
(510) 464-7970 fax
e-mail: laurat@abag.ca.gov

9

NORTH MARIN WATER DISTRICT

999 RUSH CREEK PLACE • POST OFFICE BOX 146 • NOVATO, CALIFORNIA 94948 • (415) 897-4133 • FAX (415) 892-8043

November 30, 2001

Mr. Tom Gandesbery
California Coastal Conservancy
1330 Broadway, 11th Floor
Oakland, CA 94612-2530

Mr. Eric Jolliffe
U.S. Army Corps of Engineers
San Francisco District
333 Market St., 8thFloor
San Francisco, CA 94105

RE: Notice of Intent/Notice of Preparation
Bel Marin Keys Unit V Wetland Restoration Project – Supplemental Environmental Impact Report/Statement (SEIR/S) to the Hamilton Wetland Restoration Project EIR/S
NMWD File – Wetlands

Dear Messrs Gandesbery & Jolliffe:

The purpose of this letter is to comment on the above referenced Notice of Intent/Notice of Preparation. The District is concerned about the reliability of water supply to the Bel Marin Keys (BMK) area and when planning for the recent development at Hamilton Field identified an opportunity to extend a water transmission pipeline from the Ammo Hill water tank at Hamilton Field, crossing the runway parcel and the previously proposed BMK Unit V development to the existing BMK residential area.

We continue to believe that extension of this transmission pipeline is important for water supply reliability to the BMK area, especially for health and safety purposes under emergency conditions. This transmission pipeline extension would need to be constructed in an engineered levee at an elevation above any inundation from proposed wetlands, to maintain service and access. Easements along the transmission pipeline route enabling the District to install, maintain, operate and replace the transmission main would be required.

Sincerely,

Drew McIntyre
Chief Engineer

cc: Steve Wallace, City Engineer
City of Novato
901 Sherman Ave.
Novato, CA 94945

Supervisor Cynthia Murray, Fifth District
Marin County Board of Supervisors
3501 Civic Center Drive, Suite 329
San Rafael, CA 94903

Tom Selfridge, General Manager/Engineer
Novato Sanitary District
500 Davidson Street
Novato, CA 94945

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6

From: <Campcohen@aol.com>
To: <belmarinkeys@jsanet.com>
Date: Fri, Dec 28, 2001 12:31 AM
Subject: For Tom Gandesbery: Comments on Trails for BMK V Restoration

At the December 5, 2001 Scoping Meeting, you asked for comments/suggestions about the nature of possible trails/access through the restored wetlands area.

The following suggestions come from me and my wife. We are ~8 yr residents of BMK, and my wife has for several years run 2 weekly hiking groups, which hike ~50% in Marin, the rest of the time around the bay. I tend to bike more than hike. Since the December meeting, we have hiked or biked on all the existing trails in the Unit V area to have current information to base our comments on.

In our mind(s), there is a pretty obvious set of trails that would provide access and observation, without damaging, as we see it, the wildlife habitat, and fitting with the existing and planned infrastructure.

We suggest 2 trails, North Levee, and Hamilton. The North Levee trail would follow the existing trail just south of the BMK S. Lagoon, on the levee that separates the Unit V property from the BMK S. Lagoon. The existing trail along this levee would be adequate in form. If the levee were increased to the 300' width mentioned on 12/5, the trail should run along the Restoration side, to provide the best views, access for maintenance, and decrease "leakage" of visitors into the BMK areas.

The existing trail becomes impassible near the South Lock, ~1.4 miles from the trail start at Headquarters Hill. Farm roads allow you to get to the bay levee, but they will be flooded by the project. I think it would be extremely valuable to extend this trail along the levee on the south side of Novato Creek, east of the lock, as far as that levee goes, and to the bay levee if possible. The combined views of creek, wetlands, and bay will not only be impressive, but will provide visitors with a unique, direct view of how this ecosystem works.

If the levee on the south side of the creek is breached to provide for improved flow, that would obviously limit the extent of the trail, but it should obviously extend as far as possible. (Many of us at the 12/5 meeting were skeptical that the creek levee breach was desirable, but that's another issue.) If possible this trail should run along the top of the levee, along the bay, down to the northmost bay levee breach.

The North Levee trail and the Hamilton trail, could both originate at a parking lot near the existing Pacheco Pond lot.

The Hamilton trail should run from this lot around the west side of Pacheco Pond, and join with the existing Hamilton Levee trail. The existing "trail" is unappealing, but would be much improved by having a wetlands area, instead of abandoned runways, at its base. The existing trail should also be extended to the southeast about another half mile, to meet the existing levee-top trail coming north from the Las Gallinas Sanitary plant.

There are already existing parking lots at Las Gallinas and at the south end of the existing Hamilton Levee that would provide easy access.

The trail would provide a continuous "hike" from the east end of Novato Creek to Terra Linda of ~7 miles free of traffic, and could be integrated with other bay trail networks. It would use either existing levees, or levees that need to be built anyway for the restoration; the only extra cost would be to smooth and gravel the levee tops.

Trail use should clearly be for hikers, nature "observers", and bikers. Although dogs may make some problems, as someone said at the meeting, NOT having dogs would make bigger problems. Las Gallinas requires use of leashes limited to 8' long. Motorized scooters, trail motorcycles, etc., should be excluded. Horses only if wearing diapers.

7

MARIN COUNTY COMMUNITY DEVELOPMENT AGENCY

ALEX HINDS. DIRECTOR

December 31, 2001

Tom Gandesbery
California State Coastal Conservancy
1330 Broadway, 11th Floor
Oakland, CA 94612

Eric Jolliffe
U.S. Army Corps of Engineers, San Francisco District
333 Market St., 8th Floor
San Francisco, CA 94105

SUBJECT: Comments on Notice of Intent/Notice of Preparation for Bel Marin Keys Unit V Wetland Restoration Project

Dear Messrs. Gandesbery and Jolliffe:

Thank you for providing Marin County with the opportunity to comment on the NOI/NOP for Bel Marin Keys Unit V (BMKV) Wetland Restoration Project. The County of Marin is supportive of the prospect of restoring wetlands habitat in this area as it provides an opportunity to expand upon the existing wetlands habitat restoration being undertaken at Hamilton Field (HAAF).

We ask that the following issues be addressed as part of your project development and environmental analysis:

1. In evaluation of various scenarios, potential impacts that may occur on existing waterways and flood control facilities on the project site and in the immediate vicinity (including, but not limited to Pacheco Pond, Novato Creek, and the Bel Marin Keys lagoons) need to be addressed.

2. Alignment of the Bay Trail is currently under discussion as it relates to the HAAF wetlands project and the area to the north, some of which falls within the BMKV project area. The 1994 Marin Countywide Plan contains policies related to, and delineates a Bay Trail segment through the project area. A planning team met on several occasions, including representatives from both of your agencies, to discuss alternative alignments that are not reflected in current adopted plans. While there has been concurrence by the team involved in that effort to move the trail alignment to the western edge of the HAAF runway along the New Hamilton Partnership levee, there has not been consensus on a suitable connection between the northwestern end of the runway at Ammo Hill and Bel Marin Keys Blvd. One option under discussion is routing the trail along the southern and eastern sides of Pacheco Pond to connect with Bel Marin Keys Blvd. at Headquarters Hill. Recommendations made in the Hamilton Public Access Bay Trail Plan, dated March 22, 2001, should be addressed in the supplemental EIR/S as they relate to this project.

3. The balance between sufficient public access and creation of a viable wetlands habitat needs to be addressed in detail, including where access points would be. The Bay Trail planning effort revealed a number of issues related to number of access points, design options, and structures to preclude access to certain areas by the public as well as dogs and cats which should be considered in your analysis.

We are excited about the prospect of rehabilitation of wetlands in the project area, especially in conjunction with the effort currently underway at Hamilton. Please include me on notification list at the address above. If you have any questions or comments, please contact me at this office.

Sincerely,

DAN DAWSON
Senior Planner

c: Tim Haddad, Environmental Coordinator

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DEPARTMENT OF PUBLIC WORKS

COUNTY OF MARIN

P. O. Box 4186, San Rafael, CA 94913-4186 • 415/499-6528 • FAX 415/499-3799

ADMINISTRATION 415/499-6570
ACCOUNTING 415/499-6528
AIRPORT 451-A AIRPORT ROAD NOVATO, CA 94945 415/897-1754 FAX 415/897-1264
BUILDING MAINTENANCE 415/499-6576 FAX 415/499-3250
CAPITAL PROJECTS 415/499-7877 FAX 415/499-3724
ENGINEERING & SURVEY 415/499-7877 FAX 415/499-3724
COUNTY GARAGE 415/499-7380 FAX 415/499-3738
LAND DEVELOPMENT & FLOOD CONTROL DISTRICT 415/499-6549
PRINTING 415/499-6377 FAX 415/499-6617
COUNTY PURCHASING AGENT 415/499-6371
COMMUNICATION MAINTENANCE 415/499-7313 FAX 415/499-3738
REAL ESTATE 415/499-6578 FAX 415/446-7373
ROAD MAINTENANCE 415/499-7388 FAX 415/499-3656
TRAFFIC ENGINEERING 415/499-6528
TRANSIT DISTRICT 415/499-6099 FAX 415/499-6939
WASTE MANAGEMENT 415/499-6647 FAX 415/446-7373

Mehdi Madjd-Sadjadi, P. E.
Director

December 28, 2001

Tom Gandesbery
California Coastal Conservancy
1330 Broadway, 11th Floor
Oakland, CA 94612-2530

Eric Jolliffe
U.S. Army Corps of Engineers
San Francisco District
333 Market Street, 8th Floor
San Francisco, CA 94105

Subject: Bel Marin Keys Unit V Wetland Restoration Project
Notice of Intent/Notice of Preparation

Dear Mr. Gandesbery and Jolliffe:

Thank you for the opportunity to provide input on this project. We have the following concerns:

- Once the outer levees are breached, the inner levees will be subject to direct tidal action. The inner levees were constructed long ago by means and materials unknown. Thus, their ability to withstand direct tidal action should be analyzed.
- The impact of the project on upstream water surface elevations on San Jose, Pacheco and Novato Creeks should be analyzed.
- The idea of routing the outfall of Pacheco Pond through the project along its original path should be analyzed.
- The District has a need for ongoing disposal of dredge spoils. We request that provisions be incorporated into the project for the District to dispose of material on an ongoing basis.
- The property was zoned F-2 in Marin County Ordinance No. 2001. We request the project incorporate mitigation to comply with the requirements in Marin County Code Chapter 22.95.
- The property is subject to two drainage agreements, filed in Book 3717, Page 183 and as Document No. 87-35671. We request the proposed project comply with the agreements. Should the proponent determine that a modification to either agreement is desired, please submit a request to the District in writing with appropriate backup documentation for consideration. Any modification to an agreement must be approved

by the Marin County Flood Control and Water Conservation District Board of Supervisors, after a recommendation on the matter has been rendered by the Flood Zone No. 1 Advisory Board.

- The District dredges Novato Creek in the vicinity of U.S. 101 approximately every four years. We offer this material to the Coastal Conservancy for use in constructing the project.
- The project would be exempt from a grading permit issued by Marin County Public Works under Marin County Code Section 23.08.030(2)(a). We request that the project incorporate the applicable requirements of Chapter 23 and 24, particularly for erosion and dust control.

Should you have any questions, please contact Pat Balderama at (415) 499-6549.

Very Truly Yours,

MARIN COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Craig Tackabery
Senior Civil Engineer

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JAN 0 2 2002
COASTAL CONSERVANCY
OAKLAND, CALIF.

c: Pat Balderama
Tim Haddad, CDA

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Appendix H

Draft Section 404(b)(1) Alternatives Evaluation

DRAFT
Hamilton Wetland Restoration Project
Bel Marin Keys Unit V Restoration Expansion

Section 404(b)(1) Evaluation

Clean Water Act Section 404(b)(1) authorized the development of guidelines for specification of disposal sites for dredged or fill material by the U.S. Environmental Protection Agency (USEPA) in conjunction with the U.S. Army Corps of Engineers (Corps). The USEPA subsequently developed and adopted the Section 404(b)(1) guidelines in conjunction with the Corps (40 CFR Part 230). The purpose of these guidelines is to "restore and maintain the chemical, physical, and biological integrity of the waters of the United States through the control discharges of dredged or fill material". This document reviews the compliance of the proposed restoration alternatives for the Bel Marin Keys Unit V (BMKV) Expansion of the Hamilton Wetland Restoration Project (HWRP) with these guidelines. This document incorporates by reference the information presented in the Final Supplemental Environmental Impact Report/Statement (SEIR/S) prepared for the BMKV Expansion of the HWRP.

Expansion Description

Location

The BMKV expansion site is located within the San Francisco Bay Estuary in unincorporated Marin County and Novato, California. See Figure 1-1 in Chapter 1 of the SEIR/EIS.

Overview Description

The Corps and the Coastal Conservancy is proposing to restore wetlands at the BMKV site as an addition to the HWRP already authorized for implementation at the adjacent Hamilton Army Airfield (HAAF) and State Lands Commission (SLC) parcels. The BMKV site, prior to 1850 supported bay subtidal habitat, tidal marsh, and tidal ponds. The BMKV expansion site presently consists of subsided diked baylands utilized for agriculture that also supports limited areas of subtidal mudflat, tidal marsh, and freshwater wetland and pond habitat. The proposed wetland restoration would return the site primarily to tidal wetland

conditions, establish new seasonal wetland and/or open water habitat, and reestablish important ecological functions in the San Francisco Bay Estuary.

A range of restoration alternatives was considered by the Corps, California State Coastal Conservancy (Conservancy), and San Francisco Bay Conservation and Development Commission (BCDC) prior to selection of the alternatives to be evaluated in the SEIR/EIS. Three alternatives were selected as representing a reasonable range of restoration alternatives for purposes of the National Environmental Policy Act/California Environmental Quality Act (NEPA/CEQA) document. These 3 alternative include 2 alternatives that involve the placement of dredged material to accelerate the formation of wetland elevations and 1 alternative that relies primarily on natural sedimentation. All of the alternatives include breaches to San Pablo Bay; 2 of the alternatives also include breaches to Novato Creek. Each of the alternatives has a different Bay Trail alignment. All of the alternatives include establishment of a hydrological connection to Pacheco Pond, though through different means. The alternatives are listed below.

- Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond
- Revised Alternative 2 – Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond
- Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond

Detailed descriptions of each alternative are provided in Chapter 3 of the BMKV SEIR/EIS.

Site construction activities that would be subject to regulation under Section 404 of the Clean Water Act include:

- construction of perimeter containment levees, pilot levees, phase levees, berms and internal peninsulas where these levees are located in jurisdictional waters (all Alternatives)
- placing dredged material on the BMKV site in jurisdictional waters (Alternatives 1 and 2 only);
- placing salvaged topsoil on the BMKV site in jurisdictional waters; and
- construction of portions of the Bay Trail, depending on alternative

Statutory Authority and Purpose

Refer to Section 2 of the BMKV SEIR/EIS for a discussion of the proposed expansion's statutory authority, purpose, and need.

Dredged and Fill Material

The proposed action would be constructed using fill material excavated from the expansion site and dredged material imported from offsite. Dredged material may originate from many sources, including the Port of Oakland 50-foot Deepening Project, Corps of Engineers operations and maintenance dredging program, and other non-federal dredging projects. It is possible that suitable dredged material from other dredging projects might also be used, provided the Dredged Material Management Office (DMMO) determines that the proposed material is appropriate for use as wetland cover material.

Each alternative includes the potential for salvaging of existing topsoil. The upper 1 foot of existing site soils and sediments would be excavated from designated areas, salvaged and stockpiled during the beginning stages of construction. The salvaged material would be reapplied onsite to construct and improve levees, and to facilitate the creation of season wetland and upland transition habitats in the final phase of construction.

Alternatives 1 and 2 would utilize dredged material to establish initial surface elevations of the wetlands and to create levees. Alternative 1 is estimated to require 13,200,000 additional cubic yards of dredged material (above the current HWRP), while Revised Alternative 2 is estimated to require 13,800,000 additional cubic yards. Alternative 3 would only include placement of additional dredged material on a 90-acre portion of the State Lands Commission (SLC) parcel, but would not use dredged material at the BMKV site, and would represent a decrease in the use of dredged material overall at the authorized HWRP of approximately 2,600,000 cubic yards. The placement of dredged material on the SLC parcel is already part of the authorized HWRP and was analyzed in a prior 404(b)(1) evaluation included in the Corps feasibility study for the HWRP in 1998.

A detailed description of construction activities required under each alternative is provided in Chapter 3 of the BMKV SEIR/EIS.

Discharge Sites

All 3 alternatives would require the creation of tidally influenced sub-basins to facilitate tidal wetland restoration. For Alternative 1 and Revised Alternative 2 dredged material would be used to fill the sub-basins to raise the surface elevation of the site. Alternative 3 would require the establishment of marsh plain elevations through the natural deposition of sediments from San Pablo Bay.

Habitat types on the BMKV site include coastal salt marsh tidal and nontidal, brackish open water, seasonal wetland, grassland/seasonal wetland, and agriculture. The locations of these habitats are shown on Figure 4-8 of the BMKV SEIR/EIS. During the placement of dredged material, creation of temporary and permanent levees, and breaching of outboard levee, nontidal salt marsh, brackish open water and marsh, seasonal wetlands, and agricultural lands

will be reduced or eliminated due to fill. Estimated acres of habitat types present in the BMKV site, under each alternative at maturity, and net change of habitat types from no expansion conditions to each alternative are shown on Table 4-7 of the BMKV SEIR/EIS.

Discharge Method

Dredged material is only used on the BMKV site in Alternative 1 and Revised Alternative 2. As part of Alternative 3, there would be a change to the original HWRP and dredged material would only be placed on approximately 90 acres of the SLC parcel. Dredged material would be placed on the BMKV site through use of the hydraulic off-loader and piping being built for the HWRP. The hydraulic off-loader would be located in San Pablo Bay, approximately 30,000 feet offshore. Dredged material would be transported by barge to the off-loader, mixed with bay water to form a slurry, and pumped to BMKV site. The wetland restoration expansion would begin to accept dredged material during Phase 2 of construction.

If used, salvaged topsoil would be excavated from BMKV site and moved to staging area and later used to create levees and upland and seasonal wetlands using common construction equipment such as scrapers, bulldozers, graders, and compactors.

Factual Determinations

The 404(b)(1) guidelines (40 CFR Part 230, Subpart B, Section 230.11) require the determination in writing of the potential short-term and long-term effects of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment. These factual determinations are presented below.

Physical Substrate Determinations

The surface elevation of most of the BMKV site has subsided below sea level. The bottom elevation of BMKV site would be raised by the placement of dredged material and/or the process of natural sedimentation from San Pablo Bay.

In all 3 alternatives, the construction of the levees, the placement of the dredged material, the breaching of outboard levees, and lowering of levees would result in loss of existing on-site jurisdictional water and wetlands as noted below:

In Alternative 1, approximate acreages of areas lost include:

- 21 acres of non-tidal coastal salt marsh due to fill;

- 52 acres of brackish open water and marsh due to fill;
- 114 acres of seasonal wetlands due to fill;
- 151 acres of agricultural wetlands due to fill;
- 7 acres of tidal mudflat and/or marsh due to breaches;
- 10 to 20 acres of tidal mudflat and/or marsh due to change in Novato Creek morphology due to increase in tidal prism and resultant erosion; and
- Up to 2 acres due to fill from Bay Trail construction.

In Revised Alternative 2, approximate acreages of areas lost include:

- 21 acres of non-tidal coastal salt marsh due to fill;
- 52 acres of brackish open water and marsh due to fill;
- 114 acres of seasonal wetlands due to fill;
- 151 acres of agricultural wetlands due to fill;
- 6 acres of tidal mudflat and/or marsh due to breaches;
- 10 to 20 acres of tidal mudflat and/or marsh due to change in Novato Creek morphology due to increase in tidal prism and resultant erosion.

In Alternative 3, approximate acreages of areas lost include:

- 21 acres of non-tidal coastal salt marsh due to inundation and/or fill;
- 52 acres of brackish open water and marsh due to inundation and/or fill;
- 114 acres of seasonal wetlands due to inundation and/or fill;
- 151 acres of agricultural wetlands due to inundation and/or fill; and
- 4 acres of tidal mudflat and/or marsh due to breaches.

In Alternative 1, this loss would be offset by restoration of approximately (see Table 4-7 of the SEIR/EIS):

- 1039 acres of tidal marsh;
- 147 acres of tidal and subtidal channels;
- 50 acres of brackish open water and marsh; and
- 40 acres of seasonal wetlands.

In Revised Alternative 2, this loss would be offset by restoration of approximately (see Table 4-7 of the SEIR/EIS):

- 899 acres of tidal marsh;
- 120 acres of tidal and subtidal channels; and
- 277 acres of seasonal wetlands.

In Alternative 3, this loss would be offset by restoration of approximately (see Table 4-7 of the SEIR/EIS):

- 1274 acres of tidal marsh;
- 197 acres of tidal and subtidal channels; and
- 50 acres of brackish open water and marsh.

Water Circulation, Fluctuation, and Salinity Determinations

Tidal fluctuations into and out of the restored tidal wetlands under all 3 alternatives would generate large tidal currents in and around the perimeter levee breaches. The fluid momentum associated with these flows would be rapidly dissipated along the mud flats as the channels discharge into Novato Creek and San Pablo Bay. Because of the vast size and volume of San Pablo Bay and the proximity of the Novato Creek breach to the mouth of the creek, the general effect of this momentum exchange would be insignificant away from the point of discharge. Thus, large-scale circulation patterns in Novato Creek and San Pablo Bay would not be significantly affected by the restoration alternatives.

Suspended Particulate/Turbidity Determinations

Turbidity of waters in the wetland restoration site, Novato Creek, and San Pablo Bay are not expected to change substantially under the proposed expansion. Changes in turbidity associated with constructing levees and internal peninsulas would be isolated to waters in existing drainage channels on the BMKV site.

Construction of the restoration site using the dredged disposal approach would include hydraulic placement of fill material. Dredged material would be pumped with water as a slurry from barges in the Bay to the restoration site. Once in the restoration site, the solids in the slurry would settle, and new slurry would be added. The surplus water would need to be pumped out of the restoration area and disposed of in the Bay. This surplus water, depending on the detention time, could have substantial concentrations of fines that would degrade the receiving waters by increasing the suspended solids and turbidity.

A water quality-monitoring program will be developed and implemented to ensure adequate protection for aquatic life. Before the construction phase is initiated, water quality monitoring and reporting requirements for the proposed BMKV expansion will be established by the San Francisco Regional Water Quality Control Board (RWQCB) in project-specific waste discharge requirements (WDRs) in accordance with the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California. The WDRs will likely require sampling and analysis to provide background water quality information on the proposed expansion's discharge.

The data will be used to evaluate water quality of the discharge and determine compliance with the WDRs.

Exceedance of monitoring standards may require temporary delays in material placement or the installation of turbidity curtains or other physical measures to control the flow of water and sediments.

Contaminant Determinations

The dredged material would not contain concentrations of contaminants that would harm resources in the proposed expansion site. The sediments selected for use as cover material for tidal and seasonal wetland restoration at the proposed expansion site would need to meet DMMO determinations regarding appropriate material for wetland cover. Restriction of use of sediments to those passing the cover screening criteria would ensure that no adverse impacts on surface water quality would occur.

Aquatic Ecosystems and Organisms Determinations

The proposed expansion would substantially increase the wetland acreage on the site. Implementation of any of the 3 alternatives would result in the restoration of at least 900 acres of coastal salt marsh.

The SEIR/EIS provides an impact analysis of the proposed expansion on biological resources, such as special status species. No threatened or endangered plant species are expected to be affected by the proposed BMKV expansion. Threatened or endangered species that may be affected by the BMKV expansion include: Central Valley steelhead (*Oncrhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha*), California brown pelican (*Pelecanus occidentalis californicus*), California clapper rail (*Rallus longirostris obsoletus*), and salt marsh harvest mouse (*Reithrodontomys raviventris*).

One of the expansion goals is to create and maintain wetland habitats that sustain viable populations, particularly for Bay Area threatened and endangered species. The increase in subtidal aquatic habitat in the tidal marsh would benefit resident and anadromous fish like central valley steelhead, and chinook salmon, and other non-listed species. The proposed expansion would directly benefit salt marsh harvest mouse and California clapper rail, and California brown pelican by increasing suitable habitat. Furthermore, the expansion would greatly improve suitable nesting habitat for a waterfowl and suitable habitat for migratory shorebirds.

The SEIR/EIS found that the expansion may have short-term adverse impacts on some of the listed and non-listed species. Most of these impacts would occur during the construction activities. Some of the construction impacts could be reduced or avoided by timing to avoid disturbance to breeding or migration. While some existing habitat will be lost, the long-term effect of the project will

be an increase in wetland habitat, particularly for tidal-marsh dependent species. Mitigation of impacts on Biological Resources associated with the expansion are discussed in the Biological Resources section of Chapter 4 of the SEIR/EIS.

Human Use Determinations

The proposed dredged and fill would comply with applicable water quality standards. The discharge would not affect municipal or private water supplies because the BMKV does not provide these uses. Recreational and commercial fisheries would not be affected because the BMKV site does not support a fishery for these purposes. The proposed discharge would improve water-related recreation and aesthetics because the restored site will be more visually appealing (upon maturity) and would include extension of the Bay Trail increasing recreational opportunities.

Determination of Cumulative Effects on the Aquatic Ecosystem

As indicated above, the expansion would result in short-term loss of wetland habitat; however, this short-term loss would be offset by the substantial increase in the acreage of important tidal habitat available for sensitive wildlife and fish species. The temporary loss of existing habitat would be offset by restored habitat. Implementation of the expansion would result in a beneficial cumulative effect by increasing habitat available for sensitive wildlife and fish species in the Bay Area region.

Secondary Effects on the Aquatic Ecosystem

The implementation of Alternative 1 or Revised Alternative 2 would require that the perimeter levee be breached and full tidal circulation restored across the site; some of the dredged material would be remobilized. Tidal flows and velocities at the perimeter levee breach locations would increase localized erosion in the existing tidal slough channels and bordering marsh. Remobilization of the dredged material by tidal currents and wind-generated waves across the open fetches of the site would increase local turbidity and sedimentation until the eroded material is redeposited. No substantial offsite transport is anticipated. The impacts of increased turbidity and sedimentation would be short term, and offsite transport would eventually be eliminated when equilibrium is established in the restored tidal marsh and tidal sloughs.

Findings of Compliance or Noncompliance with Restrictions on Discharge

The 404(b)(1) guidelines (40 CFR Part 230, Subpart B, Section 230.12) require written findings as to whether the proposed disposal site for the discharge of dredged or fill material:

- complies with the 404(b)(1) guidelines;
- complies with the 404 (b) (1) guidelines with the inclusion of appropriate and practicable discharge conditions to minimize pollution or adverse effects to the affected aquatic ecosystems; or
- does not comply with the 404 (b) (1) guideline requirements.

These findings are presented below.

Finding 1 – Adaptation of 404(b)(1) Guidelines

No significant adaptations of the guidelines were made relative to this evaluation.

Finding 2 – Other Practicable Alternatives With Less Adverse Impact on Aquatic Ecosystems

The goal of the expansion is to create a diverse array of wetland and wildlife habitats that benefits a number of endangered species and other migratory and resident species. This goal would be met by designing and engineering a restoration expansion that emphasizes beneficially reusing dredged material (in Alternative 1 and Revised Alternative 2), or natural sedimentation (Alternative 3) and ensuring no net overall loss of existing wetland habitats at the BMKV parcel. The proposed discharge has been designed to maximize beneficial environmental effects and increase the amount of tidal aquatic habitat on the site compared to existing conditions. Because the discharge would not result in a net adverse impact on the site habitat, the wetland and water acreage overall would substantially increase, there are no practical alternatives that would result in a less adverse impact on the aquatic ecosystem.

Finding 3 – Inclusion of conditions to minimize pollution and/or adverse effects to the affected aquatic ecosystems

As described in the SEIR/EIS, mitigation is proposed to minimize pollution and adverse effects on the existing aquatic ecosystems in Novato Creek and San

Pablo Bay. On-site aquatic habitat will be lost, but will be replace by larger areas of restored habitat. Mitigation measures relevant to reducing these effects are discussed in the water quality, biology, and hazardous waste portions of chapter 4 of the SEIR/EIS.

Finding 4 – State Water Quality Standards

The expansion would not violate applicable state water quality standards. The sediments selected for use as cover material for tidal and seasonal wetland restoration at the proposed expansion site would need to meet the DMMO determination for appropriate wetland cover criteria. Construction activity, including placement of dredged material, would be subject to requirements of the San Francisco RWQCB waste discharge requirements (WDRs) adopted for the expansion.

Finding 5 – Endangered and Threatened Species

The restoration expansion could affect areas inhabited by the following federal threatened and endangered species: Central Valley steelhead, chinook salmon, California brown pelican, California clapper rail, and salt marsh harvest mouse. For the listed federal species that may be affected by the BMKV expansion, the Corps will expand their existing consultation process for the HWRP to include the effects of proposed activities on the BMKV site. The restoration expansion would be expected to result in short-term impacts to these species, where present, but long-term benefits due to the increase in restored habitat. The expansion is not expected to result in jeopardy of any listed threatened or endangered species and is expected to contribute to the recovery of the California clapper rail and the salt marsh harvest mouse.

Finding 6 – Significant Degradation of U.S. Waters

The wetland restoration expansion would not result in significant degradation of U.S. waters. The expansion would not have a significant adverse impacts on human health and welfare, including municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites; on recreational, aesthetic, or economic values; or on aquatic ecosystem diversity, productivity, or stability.

Finding 7 – Compliance Conclusion

On the basis of the guidelines, the proposed site for the discharge of dredged and fill material for the BMKV expansion complies with the guidelines with the inclusion of the mitigation presented in the SEIR/EIS.

The purpose of the wetland restoration expansion is to:

- create substantial amounts acres of tidal and seasonal wetland and other wildlife habitat;
- implement numerous federal, state, regional, and local plans; and
- establish a partnership between state and federal agencies to accommodate habitat restoration objectives.

The wetland restoration expansion and proposed discharge have been designed to maximize beneficial effects on the aquatic ecosystem. The proposed discharge would not result in a long-term adverse impact on the aquatic ecosystem.

Appendix I

Agreement Regarding Flooding and Drainage for Bel Marin Keys Unit V Property

Agreement Regarding Flooding and Drainage for Bel Marin Keys Unit V Property

This agreement is entered into by and between the State Coastal Conservancy (Conservancy), the County of Marin (County) and the City of Novato (City) on, September 10, 2002, with respect to the following facts:

RECITALS

WHEREAS, the Conservancy is an agency of the State of California with responsibility for implementing a program of area restoration and resource enhancement in the coastal zone and San Francisco Bay, and is committed to undertaking projects to protect, restore and enhance natural habitats and connecting corridors, watersheds, scenic areas, and other open-space resources of importance to the San Francisco Bay region and the people and the wildlife of California; and

WHEREAS, the State of California, acting by and through the Conservancy, is the owner in fee of real property in the County of Marin known as Bel Marin Keys Unit V (BMKV, BMKV property, site or BMKV site); and

WHEREAS, the Conservancy acquired BMKV for wetland restoration and protection of open-space resources and natural habitats, and for expansion of the Hamilton Wetland Restoration Project (HWRP) on adjacent property (the "project"); and

WHEREAS, the HWRP was authorized by Congress in the Water Resources Development Act (WRDA) of 1999 for implementation by the Civil Works Program of the United States Army Corps of Engineers (the Corps) in cooperation with the Conservancy as the non-federal sponsor; and

WHEREAS, the Corps and the Conservancy are currently undertaking environmental review (SEIR/EIS) and feasibility analysis of the proposed addition of BMKV to the HWRP via federal legislation (WRDA 2002); and

WHEREAS, if the BMKV project is authorized by federal legislation, further actions by the Conservancy and the Corps will be required prior to its construction, including but not limited to detailed project planning and design, and execution of the Project Cooperation Agreement pursuant to which the Conservancy would provide the necessary lands, easements and rights of way for the project, the Corps would construct the project on a cost-share basis and would provide a project management plan (PMP) detailing remaining work anticipated to be complete prior to initiating construction; and

WHEREAS, the BMKV property lies within the secondary floodway zone designated F-2 under Section 22.95.010 of Marin County zoning regulations, whose purpose is to insure that life and property will be protected and to prevent increased flooding due to random and uncontrolled development which will impede the capacity of secondary floodplains to receive overflow floodwaters; and

WHEREAS, the BMKV property is the subject of drainage agreements with the Marin County Flood Control and Water Conservation District and/or Bel Marin Keys Community Services District; and

WHEREAS, the Conservancy recognizes that flood zoning (F-2 designation) and drainage agreements at BMKV are critical issues that must be addressed prior to implementing any project at the site; and

WHEREAS, the Conservancy is committed to working with the County, the City, the Bel Marin Keys Community Service District and other interested parties to resolve these issues; and

WHEREAS, studies to date by the Conservancy and the Corps include a hydrologic and hydraulic analysis that concludes that potential future conditions at the BMKV site will not significantly increase flood stage on Novato Creek if the proposed project is implemented; and

WHEREAS, the Conservancy and Corps are committed to employing sound engineering principles and scientifically-defensible approaches to designing this project; and

WHEREAS, the County has responsibility to assess the BMKV restoration project for conformance with flood zoning; and

WHEREAS, additional hydrologic/hydraulic study requested by the County and the City and currently funded by the Conservancy and the Corps to further establish the relationship of existing and potential future conditions at the BMKV site to Standard Project Flood stage as mutually agreed to by the parties, on Novato Creek and its watershed under a variety of conditions will not be completed within the period of environmental review (SEIR/EIS) and feasibility analysis of the project for purposes of authorizing the addition of BMKV to the HWRP via federal legislation (WRDA 2002); and

WHEREAS, resolution of the issues described in this agreement is of great importance to the County and the City, and all parties agree on the importance of restoring BMKV to wetlands and desire to facilitate the implementation of a wetlands restoration project on the site so long as the project does not cause significant adverse impacts to surrounding properties and the environment;

NOW THEREFORE IT IS AGREED AS FOLLOWS:

A. The above recitals accurately reflect the facts and understandings of the parties, and are incorporated herein by reference.

B. Although the Conservancy and Corps believe there are no such impacts based on current studies, the parties agree that any potential significant adverse hydrologic impacts of the wetland restoration project must be avoided, and that the governing flood protection zoning and drainage agreements for the BMKV property must be addressed to the satisfaction of the City and County consistent with this Agreement, before the Conservancy makes any formal commitment (including but not limited to executing a

Project Cooperation Agreement with the Corps) to undertake the project. The parties therefore agree that additional studies based on a mutually acceptable methodology and scope of work are appropriate, and further acknowledge that if these additional studies reveal a potential for a significant adverse hydrologic and/or hydraulic impact, the project's SEIR/EIS shall be revised to address said impacts and recirculated pursuant to applicable law. However, the parties agree that the BMKV project shall be designed such that the project meets the following Performance Standards, and that the hydrologic and/or hydraulic impacts of the project on surrounding properties should be determined on the basis of these Performance Standards:

Performance Standards

1. No increase above "baseline" as defined below in peak water surface elevations in San Jose, Pacheco, Novato Creeks and Pacheco Pond.

2. No increase above "baseline" as defined below in peak water surface elevations in the Bel Marin Keys lagoons.

3. No increase above "baseline" as defined below in peak water surface elevations in the Novato Creek watershed that would increase the potential for flooding.

Compliance with the Performance Standards will be determined by the County and City by a comparison of projected conditions with the project to projected conditions without the project.

C. The Conservancy agrees that additional hydrologic and hydraulic study being funded and carried out in cooperation with the Corps will:

1. Be developed on the basis of a scope of work that has been reviewed and approved by a qualified third-party consultant of the City and/or County with hydrology expertise;

a. This scope of work shall accurately define the present "baseline" condition of the Novato Creek watershed based on mutually agreed parameters. The model shall be calibrated based on mutually agreed parameters. The identified baseline will incorporate tidal data and hydrographs approved by the County and City.

2. Provide modeling and analysis acceptable to all parties to further establish the relationship of existing and potential future conditions at the BMKV site to Standard Project Flood as mutually agreed to by the parties on Novato Creek and its watershed under a variety of hydrologic and tidal conditions;

3. Include an analysis acceptable to the parties of levee overtopping and breaching during high water events; and

4. Be subject to peer review by a qualified third-party consultant to the City and/or County as provided below.

D. The Conservancy, the County and the City agree to work together and with the Corps to assess F-2 zoning and drainage agreement issues associated with the project and implement a mutually acceptable solution as follows:

1. If the hydrologic/hydraulic studies are determined to be adequate by the County and City and the studies conclude that the project meets the Performance Standards set forth in Section B above, the County Community Development Agency and Department of Public Works will recommend that the Marin County Board of Supervisors act affirmatively on the F-2 zoning as necessary to allow or provide for the wetlands project as proposed by the Conservancy; or the County Community Development Agency and Department of Public Works may inform the Conservancy in writing that further Board of Supervisors actions are not required as specified below.

2. If the hydrologic/hydraulic studies are determined to be adequate by the County and City and those studies conclude that the project meets the Performance Standards set forth in Section B above, then the Marin County Flood Control and Water Conservation District will work with the Conservancy to approve any necessary amendments to the existing drainage agreements required to implement the project.

3. If the hydrologic/hydraulic studies are determined adequate by the County and City and those studies conclude that the project does not meet the Performance Standards set forth in Section B above, the Conservancy agrees that it will not execute a Project Cooperation Agreement committing to implementation of the project nor commence construction of the project until flooding issues have been resolved or mitigated to the satisfaction of the County and City to meet the Performance Standards.

E. Upon completion of hydrology/hydraulic studies pursuant to Section C. above, the parties agree to the following process to address the issues identified in this agreement:

1. The County and City shall have sixty (60) days from the date of receipt of an administrative draft of the additional studies contemplated by this agreement to provide technical comments on the studies. Once the issues raised by those comments are resolved to the satisfaction of the parties, a final draft of the studies shall be issued. The County and City shall then have ninety (90) to complete the public process contemplated by paragraph E. 2. below

2. The County shall solicit input from the Marin County Flood Control and Water Conservation District, the Bel Marin Keys Community Services District, and other interested parties and members of the public, and assure that these parties' concerns are addressed.

3. If the City and County determine following the public process that the studies are adequate to address the concerns covered by this agreement and that no further actions are required, the County and City shall so inform the Conservancy in writing within 5 days of the close of the ninety (90) day period specified in E.1 above and the parties shall have no further obligations under this agreement, so long as the project is carried out in a manner that satisfies the Performance Standards. If either the City and/or the County determines that the studies are not adequate to address these concerns, then at the end of the ninety (90) day period specified in E.1 above, the party(ies) having made such determination shall notify the Conservancy, in writing. This writing shall identify the issues that in the opinion of the authors have not been resolved as well as recommend measures, if

any, that in the party's opinion could be taken to address the issues.

4. To the extent that any issues identified by the County can be resolved by means of actions necessary to (a) find the project to be consistent with F-2 zoning; or (b) amend existing drainage agreements, the County agrees to act expeditiously and in good faith to present those actions to its Board of Supervisors and affected districts, respectively. The Conservancy agrees to work with the Marin County Flood Control and Water Conservation District and Bel Marin Keys Community Services District to amend any drainage agreements as necessary to implement the project consistent with the Performance Standards. To the extent that any issues identified by the City and/or the County can be resolved through engineering design to meet the Performance Standards, the Conservancy agrees to work with the Corps, the County and City to define and implement actions needed to meet the Performance Standards.

5. If the County and/or City ultimately determines that the project will not comply with the Performance Standards, the Conservancy shall not pursue sponsorship of the project through a Project Cooperation Agreement with the Corps nor commence construction of the project until any and all flooding impacts are resolved to meet the Performance Standards as determined by the City and County. Nothing in this agreement shall be construed to otherwise limit the County or the Flood Control Districts land use, zoning, police powers, or other powers with respect to this property.

F. Except as otherwise expressly provided in this Agreement, all actions required to be taken on behalf of the City shall be taken by the Director of Public Works; all actions required to be taken by the County shall be taken by the directors of Public Works and the Community Development Agency; and all actions required to be taken by the Conservancy shall be taken by its Executive Officer. Notices required under this Agreement shall be provided as follows:

TO CITY:	City Director of Public Works C/o Steve Wallace City of Novato 901 Sherman Ave. Novato, CA 94947
TO COUNTY:	Marin County Department of Public Works C/o Craig Tackabery 3501 Civic Center Dr., Suite 304 San Rafael, CA 94903

TO CONSERVANCY: State Coastal Conservancy
1330 Broadway, Suite 1100
Oakland, CA 94612
Att: Tom Gandesbery, Project Manager

G. Each party represents that the person signing this agreement on its behalf has been duly authorized to do so and that his/her signature binds the party which he/she represents to the terms and conditions hereof.

H. This Agreement may be executed in counterparts, each of which shall be deemed an original and all of which constitute one agreement notwithstanding the fact that all parties are not signatories either on the same date or to the same counterpart.

ON THIS DAY:

IN WITNESS WHEREOF, the parties hereto agree to carry out this agreement:

Sam Schuchat, Executive Officer
State Coastal Conservancy

Cynthia Murray

Cynthia Murray
President, Board of Supervisors
County of Marin

Rod Wood

Rod Wood, City Manager
City of Novato

Appendix J

Land Use Policy Consistency Analysis

Plan Policy	Consistency Analysis	Proposed Project Consistent With Policy?
Marin Countywide Plan		
Policy EQ-2.42: Wildlife and Aquatic Habitats.	Implementation of the proposed wetland restoration project[1] would result in tidal wetland, other tidal habitats, seasonal wetland, and upland habitats. The proposed wetland restoration project would also preserve and enhance the diversity of wildlife and aquatic habitats.	Yes
Policy EQ-2.43: Development and Access Limitations in Bayfront Conservation Areas. *Program EQ-2.43a: Wetland Impact Mitigation.* *Program EQ-2.43b: Reduce Impacts to Wetlands.* *Program EQ-2.43c: Criteria for Evaluating Projects.* *Program EQ-2.43d: Establish Criteria for Buffer Zones.*	The proposed wetland restoration project is not a development project as defined by the Marin County Community Development Agency. Further, public access features have been relocated to the perimeter of the site. In addition, buffer areas occur between developed areas and restoration areas. The project includes a balance of activities (i.e., increase in subtidal aquatic habitat, short term loss and long term increase in intertidal mudflats, reduced access to freshwater habitat for salmonids, temporary construction impacts to fish) that will generally contribute to the improved condition of the Bay and its fisheries and fish habitats. Existing agricultural and seasonal wetlands will be replaced with seasonal wetlands and tidal wetlands, as described in *Chapter 3*.	Yes
Policy EQ-2.44: Tidelands Subzone.	The proposed wetland restoration project will create new areas subject to tidal action and will not eliminate any current areas.	Yes
Policy EQ-2.45: Diked Historic Marshlands Subzone.	Alternative 1 and Revised Alternative 2 (Preferred Alternative) would require the placement of dredged material and all three alternatives would include construction of levees on the BMKV site. While these activities might be considered "fill", these activities are proposed in the overall purpose of enhancing the wildlife and aquatic habitat value of the BMKV site and in implementing the overall site design.	Yes

[1] "proposed wetland restoration project" refers to all the Alternatives evaluated in the SEIR/S.

Plan Policy	Consistency Analysis	Proposed Project Consistent With Policy?
Policy EQ-2.46: Freshwater Habitats.	Pacheco Pond is a freshwater habitat that will be retained and enlarged as a result of the project.	Yes
Policy EQ-2.47: Use of Flood Barriers for Seasonal Habitat.	The seasonal wetland that is separated from the rest of the tidal marsh is intended to provide some flood control/habitat use.	Yes
Policy EQ-2.48: Transfer of Development Rights.	The project is a restoration project and no transfer of development rights are included as part of the project	NA
Policy EQ-2.49: Planned District Development Review with Environmental Assessment.	This SEIR/EIS constitutes an environmental assessment that the County can use to evaluate the proposed wetland restoration project against; however since the project is not considered "development" by CDA staff, the policy would not strictly apply.	Yes
Policy EQ-2.50: Coordination with Trustee Agencies within Bayfront Conservation Areas. *Program EQ-2.50a: Early Consultation with Other Agencies.*	The DFG, USFWS, USACE, EPA, RWQCB, and BCDC have all been consulted during the course of this project. The Conservancy and the Corps are the lead agencies.	Yes
Policy EQ-2.51: Minimal Impacts Within Bayfront Conservation Zone.	No significant impacts have been identified with regard to earth disturbance. The most substantial issue related to this policy is the potential for degradation of surface water and sediment quality due to increased methylmercury formation potential. This effect is identified as significant and unavoidable. The *Water Quality* section in *Chapter 4* describes this impact in detail.	No
Policy EQ-2.52: Disruption to Runoff and Stream Flow.	Novato Creek salinity level changes are considered less than significant. Potential circulation changes in Pacheco Pond would be addressed with a water management plan since there is the potential for diminished water quality.	Yes
Policy EQ-2.53: Siting of Industrial Facilities.	Implementation of the proposed wetland restoration project does not include any development of industrial facilities	Yes

Plan Policy	Consistency Analysis	Proposed Project Consistent With Policy?
Policy EQ-2.54: Tides and Currents.	The tidal hydraulics analysis presented in Chapter 4 does not identify any significant adverse impacts on tides and currents. The analysis does present a potential for a beneficial increase in dissolved oxygen concentrations in receiving waters.	Yes
Policy EQ-2.54: Bay Fill.	Creation of the wetland habitat will occur by placement of dredged material on the BMKV site. Use of the dredged material to create the habitat mix will enhance the current habitat on the BMKV site. The project would not retard currents, increases the deposition of sediments (except on the site to create marsh features), or cause erosion or pollution.	Yes
Policy EQ-2.56: Waste Discharge.	There will be no operational waste discharge as part of the project. Runoff during construction would be conducted in accordance with WDRs from the SF RWQCB.	Yes
Policy EQ-2.57: Basin Plan.	The proposed wetland restoration project will enhance existing habitat and natural resources on the project site.	Yes
Policy EQ-2.58: Protection of Existing Agricultural Lands.	The agricultural land at the BMKV parcel is not designated prime farmland, unique farmland, or farmland of statewide importance, is a small portion of available Marin County agricultural land, and has not produced substantial crops to support the local agriculture economy. While agricultural land can be compatible with wildlife habitat, the proposed wetland restoration would provide a significant enhancement of the wetland and aquatic habitat of the site compared to the existing setting. Because the project is not considered "development" by the County CDA staff, this policy does not apply.	NA
Policy EQ-2.59: Natural Vegetation.	The proposed wetland restoration is not an agricultural project.	Yes
Policy EQ-2-60: Pesticides, Insecticides and Similar Materials.	The project design and implementation will be coordinated with the Marin-Sonoma Mosquito and Vector Control District and would result in reduction of mosquito habitat compared to existing setting. See Mitigation PH-1.	Yes

Plan Policy	Consistency Analysis	Proposed Project Consistent With Policy?
Policy EQ-2-61: Consistency with Environmental Hazards Element.	The proposed wetland restoration project does not propose development.. Compliance with hazardous waste regulations is described in detail in the *Hazardous Substances and Waste* section in *Chapter 4* of the SEIR/S.	Yes
Policy EQ-2-62: Areas Underlain by Deposits of Bay Muds.	The proposed wetland restoration project is for habitat purposes, which the MCP says is a preferred use for areas of bay mud.	Yes
Policy EQ-2.63: Sites with Poor Soils Conditions or Seismically Active.	The proposed wetland restoration project does not propose development.	Yes
Policy EQ-2.64: Land Uses in Floodplains.	The project is a habitat project not a flood control project. However, the project will reduce peak stage in Pacheco Pond and will play a role in routing overflow flood waters	Yes
Policy EQ-2.65: 100-year Floodplain.	Compliance with flood zoning to be determined by MCFCWCD under agreement with Conservancy.	TBD
Policy EQ-2.66: Use of Shoreline Areas.	Ecological considerations preclude the use of the shoreline for public access; however project provides for adjacent extension of Bay Trail which will facilitate shoreline views.	Yes
Policy EQ-2.67: Ensuring Public Access of Shoreline Areas.	The Revised Alternative 2 (Preferred Alternative) will not include a spur trail in part to avert present and future habitat conflicts. However, the project includes the Bay Trail between the restoration project and the residential community, thereby buffering biological resources and providing public access.	Yes
Policy EQ-2.68: Public Access Easements.	The proposed wetland restoration project includes a Bay Trail segment. No determination is made at this time regarding dedication of easements.	Yes
Policy EQ-2.69: Evaluation of New Public Access Areas.	The County has stated that the Bay Trail alignments for each of the alternatives are acceptable; the preferred alternative route for the Bay Trail is consistent with local planning.	Yes
Policy EQ-2.70: Siting and Design of Public Access.	The Bay Trail has been designed to minimize access impacts on resources and on the adjacent residential community	Yes

Plan Policy	Consistency Analysis	Proposed Project Consistent With Policy?
Policy EQ-2.71: Wildlife, Recreation, and Educational Uses.	The proposed wetland restoration project includes provisions for access and an interpretive center.	Yes
Policy A.1.1: Preservation of Agricultural Lands. Program A-1.1a: Land uses of Inland Rural and Coastal Recreation Corridors. Program A-1.1b: Very Low Density Agricultural Zoning. Program A-1.1c: Agricultural Zoning Study and Code Revisions. Program A-1.1d: Transfer of development Rights.	The proposed wetland restoration project does not propose development. Agricultural wetlands would be replaced by seasonal wetlands and other tidal habitats.	NA
Policy A-1.4: Development in Agricultural Areas. Program A-1.4a: Agricultural Zoning and Subdivision Regulations Division.	The proposed wetland restoration project does not propose development. Agricultural wetlands would be replaced by seasonal wetlands and other tidal habitats.	NA
Policy A-1.6: Agricultural Lands in the Bayfront Conservation Zone. Program A-1.6a: Identify Agricultural Lands in the Bayfront Conservation Zone.	The agricultural land at the BMKV parcel is not designated prime farmland, unique farmland, or farmland of statewide importance, is a small portion of available Marin County agricultural land, and has not produced substantial crops to support the local agriculture economy. While agricultural land can be compatible with wildlife habitat, the restoration alternatives would provide a significant enhancement of the wetland and aquatic habitat of the site compared to the existing setting.	NA
Policy A-1.7: Intensity of Agricultural Use. Program A-1.7a: Use of Reclaimed Water for Agriculture.	The project site is not suitable for agricultural preservation because it is not designated prime farmland, unique farmland, or farmland of statewide importance, is a small portion of available Marin County agricultural land, and has not produced substantial crops to support the local agriculture economy	NA

Plan Policy	Consistency Analysis	Proposed Project Consistent With Policy?
Policy A-1.8: Bayfront Conservation Zone (BFC). Program A-18a: Agricultural Land Mitigation Fund. Program A-1.8b: Maintenance of Production Capacity. Program A-1.8c: Use of Other Techniques to Preserve Agricultural Land.	The project site is not suitable for agricultural preservation because it is not designated prime farmland, unique farmland, or farmland of statewide importance, is a small portion of available Marin County agricultural land, and has not produced substantial crops to support the local agriculture economy	NA
City of Novato General Plan		
EN Policy 11 Bayland Overlay Zone.	The proposed wetland restoration project will enhance natural resources on the site.	Yes
EN Policy 12 Bayland Area Protection.	The Revised Alternative 2 (Preferred Alternative) Bay Trail has been routed to the eastern edge of Pacheco Pond. Additionally, the proposed wetland restoration is not considered development as defined by the Marin County Community Development Agency, and, on balance, would enhance biological resources on site compared to the existing conditions.	Yes
EN Policy 13 Views.	The reduced levee heights and re-locations will ensure that existing views of San Pablo Bay from adjacent land uses will not be significantly effected. The new levees will be at an initial height of 10 feet (settling to 8 feet). The new levee separating the tidal marsh area and the non-tidal area has been moved so that it is located at least 1,500 feet from the south lagoon levee. New extension of trail will enhance public access to views of area.	Yes
EN Policy 14 Tidal Areas.	The proposed wetland restoration project will add to the area subject to tidal action since it is a marsh restoration project.	Yes
EN Policy 16 Public Access and Water-oriented Uses.	The Revised Alternative 2 (Preferred Alternative), no longer includes a spur trail, however the Bay Trail will provide public access consistent with environmental considerations. The project restores tidal marsh and provides seasonal wetlands. The project does not include wastewater reclamation or flood control features.	Yes

Plan Policy	Consistency Analysis	Proposed Project Consistent With Policy?
EN Policy 50 Integrated Trails System.	The Revised Alternative 2 (Preferred Alternative), no longer includes a spur trail, however, it includes the Bay Trail routed around the eastside of Pacheco Pond, and the last portion around the Westside of Headquarters Hill.	Yes
San Francisco Bay Plan		
To the greatest extent feasible, the Bay marshes, mudflats, and water surface area and volume should be maintained and, whenever possible, increased. Fresh water inflow into the Bay should be maintained at a level adequate to protect Bay resources and beneficial uses. Bay water pollution should be avoided.	The proposed wetland restoration project proposes to increase the amount of tidal marsh habitat.	Yes
To assure the benefits of fish, other aquatic organisms and wildlife for future generations , to the greatest extent feasible, the Bay's tidal marshes, tidal flats, and subtidal habitat should be conserved, restored and increased.	The proposed wetland restoration project proposes to increase the amount of tidal marsh habitat.	Yes
In reviewing or approving habitat restoration programs the Commission should be guided by the recommendations in the Baylands Ecosystem Habitat Goals report and should, where appropriate, provide for a diversity of habitats to enhance opportunities for a variety of associated native aquatic and terrestrial plant and animal species.	The proposed wetland restoration project proposes to increase the amount of intertidal, subtidal and tidal marsh. Seasonal wetlands will also be created.	Yes
The surface area of the Bay and the total volume of water should be kept as large as possible in order to maximize active oxygen interchange, vigorous circulation, and effective tidal action. Filling and diking that reduce surface area and water volume should therefore be allowed only for purposes providing substantial public benefits and only if there is no reasonable alternative.	The proposed wetland restoration project proposes to increase the amount of tidal marsh habitat.	Yes

Plan Policy	Consistency Analysis	Proposed Project Consistent With Policy?
Where and whenever possible, former tidal marshes and tidal flats that have been diked from the Bay should be restored to tidal action in order to replace lost historic wetlands or should be managed to provide important Bay habitat functions, such as resting, foraging and breeding habitat for fish, other aquatic organisms and wildlife. As recommended in the Baylands Ecosystem Habitat Goals report, around 65,000 acres of areas diked from the Bay should be restored to tidal action. Further, local government land use and tax policies should not lead to the conversion of these restorable lands to uses that would preclude or deter potential restoration. The public should make every effort to acquire these lands from willing sellers for the purpose of restoration.	The site is currently diked for agricultural use. The project proposes to increase the amount of tidal marsh habitat.	Yes
To ensure adequate capacity for necessary Bay dredging projects and to protect Bay natural resources, acceptable non-tidal disposal sites should be secured and the Deep Ocean Disposal Site should be maintained. Further, dredging projects should maximize use of dredged material as a resource consistent with protecting and enhancing Bay natural resources, such as creating, enhancing, or restoring tidal and managed wetlands, creating and maintaining levees and dikes, providing cover and sealing material for sanitary landfills, and filling at approved construction sites.	Alternative 1 and Revised Alternative 2 (Preferred Alternative) would use dredge materials to create new habitat.	Yes
Public access should be integrated early in the planning and design of Bay habitat restoration projects to maximize public access opportunities and to avoid significant adverse effects on wildlife.	A spur trail has been eliminated from the Revised Alternative 2 (Preferred Alternative) for adverse effects. The bay trail has also been routed to reduce and minimize adverse effects, while providing for public access opportunities.	Yes

Appendix K

Draft Monitoring and Adaptive Management Plan

Bel Marin Keys Unit V Expansion of the Hamilton Wetland Restoration Project
DRAFT CONCEPTUAL MONITORING AND
ADAPTIVE MANAGEMENT PLAN
October 2002

INTRODUCTION

After construction is completed the site will be monitored for a period of 13 years to ensure that the site is maturing and performing as designed. The Corps of Engineers will participate in the monitoring and adaptive management program for 13 years after the end of construction. Subsequent inspection and surveillance of the project in connection with its obligation for operating, maintaining, repairing, rehabilitating and replacing the project will be the responsibility of the non-Federal Sponsor.

At any time during the 13-year monitoring period, if the results of monitoring indicate that any features of the constructed project require modification or if new features are required for the project to perform as intended, then adaptive management measures may be implemented. This plan provides a general framework for monitoring and managing the success of the Bel Marin Keys Unit V Expansion of the Hamilton Wetlands Restoration Project after construction. Included is guidance for monitoring levee performance, site hydraulics including channel and creek morphology, biological success, public health (mosquito breeding habitat), and water quality. This conceptual plan will be greatly expanded and quantified in the detailed design phase of the study.

It should be noted that a separate operation and maintenance (O&M) manual will be prepared by the Corps and provided to the Sponsor upon completion of construction. O&M tasks will be performed by the Sponsor to ensure that the project features are maintained in their as-built condition (or as modified by adaptive management measures) for the entire project life.

This plan covers the period after the completion of construction. Prior phases of the project include the detailed design phase and the construction phase. The SEIR/EIS identifies specific project features and mitigation measures to be implemented during the design phase (such as development of specific trail designs or development of a water management plan) or to be implemented during the construction phase (such as pre-construction nest surveys). Maintenance and monitoring during construction (e.g., spill prevention, erosion control, discharge of decant water, avoidance of special-status species) will be further described in the plans and specifications for construction. Testing of sediments for contaminants and evaluation of sediment quality will be completed by responsible parties for proposed dredged material for reuse and the DMMO prior to transportation to the site during the construction phase.

At the beginning of the post-construction phase period, dredged material will have been placed and the outboard levees breached.

Contemporaneously with the commencement of the Monitoring and Adaptive Management Period, the non-Federal Sponsor will assume exclusive responsibility for the performance and funding of the operation, maintenance, repair, rehabilitation, and replacement of the project, and the two programs will run concurrently. The distinction between the Sponsor's maintenance, repair, rehabilitation, and replacement responsibilities, on the one hand, and the adaptive management activities shared for the 13-year period by the Government and the Sponsor, on the other hand, will be determined as the detailed Monitoring and Adaptive Management Plan and the OMRRR Manual are developed.

Monitoring of biological, hydrological, topographic, bathymetric, and water quality conditions will track the evolution of the site after breaching of the outboard levees. Periodic comparisons of measured

conditions with expected conditions will determine whether the development of the site is progressing as planned.

Restoration goals and objectives for the project are qualitative statements in the SEIR/EIS regarding expected future conditions. Quantitative standards intended to measure progress towards these goals and objectives will be developed later for the detailed monitoring, and adaptive management plan.

LEVEES AND WATER MANAGEMENT STRUCTURES

Monitoring

SETTLEMENT. Monitoring of settlement of the levees due to foundation consolidation should be performed annually by means of precision level surveys of settlement monuments installed during construction. The greatest rate of settlement is expected to occur during the first ten years after the levees are constructed. The data should be reduced, plotted, and compared with the expected design rate. Settlement monitoring of the levees should continue annually until the analyses of the survey data shows that the rate and amount of settlement are within design expectations. At that time the frequency of settlement monitoring may be adjusted to longer intervals of time. If the rates and amount of settlement are unacceptable, then corrective measures should be recommended and action taken.

ANNUAL INSPECTIONS. During the first few years after breaching of the outboard levees, a walkover inspection of the levees and water management structures should be performed twice annually for pre- and post-winter conditions. Subsequently, the frequency of inspection of levees can be reduced to one annual post-winter inspection. The reduced frequency would be based upon determining that the performance of the levee features, and of the site in general, are in accordance with design expectations. Inspection of water management structures should continue on a twice-annual schedule.

The inspection should look for erosion problems such as rills, gullies, and other evidence of erosion on the newly constructed levees, and for evidence of burrowing mammals. Burrowing mammals, when present in large enough numbers, are detrimental to the overall stability of a levee. Burrowing mammals should be eradicated when infestations endanger the perimeter levee system, and the damage repaired. The breach openings should also be inspected for any obstructions or debris that would limit tidal flows. The walk over inspection should document the implementation of previously recommended corrective actions (or the lack thereof) and the effectiveness of that action.

The inspection of water management structures should look for structural integrity, settlement vegetation accumulation, sediment accumulation, or other features that may impede operation of the structure.

The annual inspections may be supplemented as necessary following a major storm event or an earthquake of magnitude 5 or greater located within 50 miles of the project, or a smaller magnitude event if specific reports of local damage are received.

CROSS SECTIONS. Surveyed cross-sections of the perimeter levees and any waterside, wave-erosion protection berms should be performed annually until they have stabilized, but no less than five years after the breaching of the outboard levees. Supplemental surveys should be made after a severe storm event or a major El Nino winter.

INSPECTION REPORT. An inspection report should be written for each inspection documenting the observations and finding, recommended corrective action items, and actions taken. In general, the monitoring and inspection report should include but not be limited to the following:

A. A site map indicating the areas of significant findings and/or observations.

B. Condition of the breaches, once they are created, noting obstructions and debris.

C. Condition of the levees and any recent repairs, noting any unusual, abnormal, or unexpected conditions or occurrences that could bear on the effectiveness of the structure.

D. Results of the settlement monitoring and interpretation of the data.

E. Condition of hard structures, water management structures (such as culverts or weirs), and pipelines.

F. Condition of access and service roads, especially areas where problems are likely to develop.

G. Availability of emergency supplies necessary for immediate repairs of major storm related damages.

H. An emergency action plan that includes phone numbers and means of contacting operating personnel.

I. Corrective measures taken (date temporary measures taken, permanent repairs, etc.) and the cost of corrective actions for the report period.

J. A summary of findings, proposed corrective actions, and an implementation plan for those actions.

Maintenance and Adaptive Management

Corrective actions in response to problems identified when monitoring levee conditions as described in the section on monitoring, above, may entail either maintenance activities or adaptive management activities. The distinction between these two categories of activities will be developed in greater depth in the detailed Monitoring and Adaptive Management Plan and the OMRRR Manual, respectively. Corrective actions could include adding material to compensate for excessive settling or erosion, repair of earthquake damage, reinforcing the levee surface to withstand erosion in problem areas (to the minimum extent necessary), repair of drainage structures, or control of burrowing rodents. Any rodent-control efforts will need to be carefully planned and executed to avoid negative impacts on adjacent habitats and wildlife. Such efforts would be confined to levees; rodent populations in other habitat areas including berms would not be controlled except under unusual conditions.

HYDRAULICS

Monitoring

DREDGED MATERIAL FILL ELEVATION AND TIDAL SEDIMENTATION. The surface elevation of the dredged material fill after consolidation will be an important determinant of the success of the project. Proper development of the tidal marsh requires that the fill elevation be low enough to allow additional sedimentation and development of tidal channels on the site after breaching of the outboard levees. If significant portions of the fill are placed above the intended elevation, formation of small marsh channels will be inhibited and the eventual quality of the marsh habitat will be reduced. In contrast, if the fill elevation is lower than intended, the only negative impact would be a delay in marsh development while additional sedimentation raises the grade level to the intended elevation.

Dredged material placed on the site will consolidate over time, with the fastest consolidation occurring initially. The degree of consolidation and its duration will depend upon the texture and depth of the dredged material. By the time that the outboard levees are breached, most consolidation will have already occurred. During the next several years, some additional consolidation may occur and could counteract tidal sediment deposition during that period.

While monitoring the surface elevation of the fill material during and immediately after completion of placement is important, this is part of the construction process and is not part of post-construction monitoring. Measurement of the fill elevation as part of the post-construction monitoring of the site will commence upon the breaching of the outboard levees, and will continue thereafter primarily to measure ongoing sedimentation on the site. These elevation data will also provide the baseline for measuring the physical development of the marsh plain and channels following the introduction of tidal action.

Monitoring of sediment deposition rates and patterns will provide useful information regarding the accuracy of predictive sedimentation models and will help to quantify the acceleration of marsh restoration achieved by using dredged material. This information will be important in future decisions regarding the use of dredged material in marsh restoration projects. Information regarding sediment deposition patterns will also assist in understanding changes in vegetation patterns as the marsh develops and will provide a basis for evaluating the effectiveness of the interior peninsulas in accelerating sediment deposition. The techniques to be used in monitoring site elevations will be determined during the detailed design stage, but could include transects across the site and/or resistivity staffs as used at the Sonoma Baylands project.

EXTERIOR TIDAL CHANNELS. To provide initial tidal access to the site, channels will be excavated to connect the site to the waters of San Pablo Bay and Novato Creek. These channels will be large enough to provide substantial tidal circulation, but will be smaller than the final equilibrium size. As the tidal hydrology of the site and its connecting channels evolves, the channels are expected to increase in size until they reach equilibrium with the tidal prism of the site. As the tidal prism eventually decreases due to sedimentation on the site, the channels will decrease in size in response. To ensure that the site is developing properly, the geometry of these channels will be monitored periodically and will be compared to expected conditions.

NOVATO CREEK CHANNEL MORPHOLOGY. To provide tidal exchange to the site, a breach will be constructed in the outboard levee to connect the site to Novato Creek. Additionally, during high flow periods, outlet flows from Pacheco Pond will be diverted to provide a source of freshwater for the seasonal wetland habitat area. These activities may result in changes in Novato Creek channel morphology (i.e., creek width and depth); although based on study to date, the changes are expected to be favorable in terms of navigation (due to the addition of tidal prism) and less than significant in terms of habitat and levee stability. Baseline conditions will be monitored for several years prior to breach of the BMKV/Novato Creek levee. The geometry of the Novato Creek channel will be monitored annually at designated locations upstream and downstream of the site and compared to the baseline conditions to quantify the magnitude of these changes. Specific monitoring locations will be determined during the detailed design phase. If monitoring identifies any significant adverse changes in channel morphology (e.g., excessive project-related sediment deposition, or erosion of adjacent levees), adaptive management measures will be identified and implemented as appropriate. Monitoring of the Novato Creek channel will be coordinated with the Bel Marin Keys Community Services District, given the interest of the BMK community in navigation via the channel and due to the periodic dredging of the channel by the BMK CSD.

TIDAL REGIME. The intent of the project is to create a tidal marsh with physical and biological conditions similar to natural marshes in the general area. The creation and maintenance of a normal tidal

regime is a very important component of restoration, as tidal action and suspended sediment circulation are essential to the creation and maintenance of tidal marsh topography and vegetation. The progress of the site's tidal regime towards reference conditions will be monitored using appropriate recording equipment. Measurements of tide elevations will be recorded periodically or continuously at locations within the site and at a nearby reference location. The tidal regime and tidal prism will be determined from these measurements.

INTERNAL PENINSULA CREST ELEVATIONS. The internal peninsulas are intended as temporary features to reduce wind and wave fetch, direct tidal flows away from levees, and encourage sedimentation. They are expected to gradually erode away and eventually disappear. The elevation of the peninsula crests will be periodically measured to monitor their progress towards specified standards.

INTERNAL CHANNEL DEVELOPMENT. Tidal channels are the most important physical feature of a tidal salt marsh. The extent, pattern, and density of the channel system determines many other attributes of the marsh, including hydrology, vegetation distribution, and habitat values. It is therefore important to document these attributes of channel development in the Hamilton restoration project for use in the design of future wetland restoration projects.

Channel development will be mapped from aerial photographs taken during appropriate tidal conditions. Transects may also be useful in measuring the development of these channels.

Maintenance and Adaptive Management.

Corrective actions in response to problems identified when monitoring project hydraulics may entail either maintenance activities or adaptive management activities. The distinction between these two categories of activities will be developed in greater depth in the detailed Monitoring and Adaptive Management Plan and the OMRRR Manual, respectively. Corrective actions will consist of removal of any debris that obstructs tidal flows.

WATER QUALITY

Water quality parameters to be monitored will include salinity, temperature, and dissolved oxygen. Measurements will be taken at several locations within the site and in the connecting channels. Due to the substantial tidal exchange that should exist immediately after breaching, water quality should be comparable to that in adjacent parts of the bay. If water quality deficiencies are substantial and persistent, remedial actions will be developed and implemented if practicable.

Additionally, a specific monitoring and adaptive management plan will be developed and implemented to address methylmercury production and accumulation in the restoration site. The plan including specific monitoring parameters (e.g., duration, frequency, constituents, protocols) will be developed in consultation with the responsible regulatory agencies. The purpose of the monitoring would be to determine whether methylmercury concentrations are found at substantially greater concentrations in the water column, sediments, or benthic invertebrate populations at the restoration site than at reference sites. Corrective actions, if required, will be developed and implemented in consultation with the responsible regulatory agencies.

Implementation of the project will also require coordination with the Marin County Flood Control Water Conservation District and the California Department of Fish and Game to ensure that any water quality monitoring aspects related to the new water management plan for Pacheco Pond are implemented. The

development of a new water management plan will be part of the design phase, but its implementation would occur after construction.

BIOLOGICAL RESOURCES

Monitoring

MARSH DEVELOPMENT (FROM MITIGATION MEASURE BIO-8). The Corps, in conjunction with the Conservancy or its successors in interest, will develop and implement a monitoring and adaptive management program to measure the rate of tidal coastal salt marsh establishment and the quantity and quality of established coastal salt marsh. Restored coastal salt marsh will be monitored annually for the first 5 years, and again in years 10 and 15 following breaching of the outboard levees. The Corps and Conservancy (or its successor) would be responsible for the first 5 years of monitoring and the monitoring in year 10. The Conservancy (or its successor) would be responsible for monitoring in year 15, because it is beyond the 13-year Corps monitoring period. The monitoring program will be designed to determine whether coastal tidal marsh is developing and whether its primary supporting physical processes (i.e., tidal exchange and sedimentation) are occurring at the estimated rate during the first 15 years following completion of construction. Subsequent inspection and surveillance of tidal salt marsh development at year 15 and beyond will be the responsibility of the non-Federal Sponsor in connection with its obligation for operating, maintaining, repairing, rehabilitating, and replacing the project. Because it will occur beyond the 13-year Project monitoring period, the Conservancy will independently assume (including on behalf of any successors) the responsibility for monitoring in year 15, in addition to its obligation to conduct inspection and surveillance of the project.

Major elements of the monitoring program will include the following:

- Measure the extent of tidal coastal salt marsh removed to determine the amount of tidal coastal salt marsh that would need to be restored to compensate for loss of tidal coastal salt marsh at an in-kind replacement ratio of 2 acres restored for every acre of tidal salt marsh removed.

- Monitor parameters, including tidal stage, tidal current, wind speed and direction, wave characteristics, suspended sediment concentrations, sedimentation rates and distribution, marsh elevations, mudflat elevations, areal extent and locations of established or colonizing salt marsh vegetation, composition and density of established and colonizing plant species, characteristics of subtidal channel and marsh surface sediments, and San Pablo Bay shoreline characteristics.

- Monitor locations, including the tidal wetland interior, tidal wetland perimeter, subtidal channels, and existing San Pablo Bay marsh shoreline.

- Compare predicted and measured site development and function.

- Analyze monitoring data to identify possible reasons for differences between observed and predicted conditions.

- Recommend corrective actions that could be implemented if the restoration is not proceeding as designed.

Monitoring reports will be submitted by the Conservancy, Corps, or successors in interest to DFG, USFWS, NMFS, and BCDC for each year in which monitoring of the development of coastal tidal salt marsh is done.

At the end of the initial 5-year monitoring period, if the development rate of the coastal salt marsh and the habitat quality of establishing coastal salt marsh do not appear to conform to the goals and projections established for the project, or do not appear sufficient to replace each acre of removed tidal coastal salt marsh with 2 acres of contiguous in-kind habitat within 10-years of levee breach, the Corps, in conjunction with the Conservancy or its successors in interest, will review the proposed BMKV expansion with representatives of DFG, USFWS, and NMFS to obtain input as to whether additional monitoring, adaptive management actions, or modifications are necessary to ensure the functions and values of the affected coastal salt marsh habitat will be replaced. The Corps, in conjunction with the Conservancy or its successors in interest, may initiate a similar review of marsh development following completion of monitoring in year 10 if the Corps or Conservancy concludes that additional actions or modifications are necessary to meet restoration goals. The Conservancy or its successors in interest, may initiate a similar review of marsh development following completion of monitoring in year 15 if they concludes that additional actions or modifications are necessary to meet restoration goals.

Monitoring or morphologic evolution will allow the Corps, in conjunction with the Conservancy or its successors in interest, to assess the success of habitat development and make decisions regarding corrective measures if necessary. Potential corrective measures include changing the breach and subtidal channel dimensions, altering perimeter levee berm morphology, and modifying channel characteristics within the restored tidal wetlands to ensure adequate morphologic evolution.

USE BY BIRDS. As intertidal mudflat and marsh habitats develop along with associated invertebrate fauna, use of these habitats by birds should gradually become similar to usage occurring on nearby intertidal habitats. As seasonal wetlands develop, winter use by waterfowl and shorebirds should become similar to such use on nearby seasonal wetlands. Periodic bird surveys will document trends in use of the site by birds in comparison to a nearby reference site and will provide an indication of the success of habitat restoration.

USE BY FISHES. Fish surveys early in the restoration process will document the initial suitability of the site for fishes. Ongoing surveys will document continued use of the site by fishes as marsh and channel formation occur.

USE BY ENDANGERED SPECIES (CALIFORNIA CLAPPER RAIL AND SALT MARSH HARVEST MOUSE). As marsh and channel development progress, habitats for the California clapper rail and the salt marsh harvest mouse are expected to gradually develop. After suitable habitat has developed over a portion of the site, periodic surveys will document the extent of these habitats and the presence of these species. Surveys will be coordinated with the U.S. Fish and Wildlife Service and the California Department of Fish and Game to ensure compliance with endangered species laws and regulations.

BENTHIC MACROINVERTEBRATES. Development of a benthic macroinvertebrate community should occur rapidly after the initial establishment of tidal action on the site. The presence of a thriving benthic macroinvertebrate community (together with abundant fish and bird populations) will indicate that the site is ecologically healthy even if it has not yet developed substantial tidal marsh habitat. However, the composition of this community can be expected to change rapidly and unpredictably due to normal natural fluctuations, which would lessen the value of monitoring trends in these species. Surveys of benthic macroinvertebrates will be conducted during the first year after breaching to document the colonization of the site by these species. Additional surveys may be conducted later if site deficiencies arise.

SEASONAL WETLAND, EMERGENT MARSH, AND OPEN WATER (FROM MITIGATION MEASURE BIO-9). The Corps, in conjunction with the Conservancy or its successors in interest, will develop and implement a 5-year monitoring program to measure the establishment rate, quantity, and quality of brackish open water, emergent marsh, and/or seasonal wetlands.

Major elements of the monitoring program will include the following.

- Measure areal extent and locations of established or colonizing marsh vegetation.
- Measure composition and density of established and colonizing plant species.
- Compare predicted and measured site development and function.
- Analyze monitoring data to identify possible reasons for differences between observed and predicted conditions.
- Recommend corrective remedial actions that can be implemented if the restoration is not proceeding as designed.

Monitoring reports will be submitted by the Conservancy, Corps, or successors in interest to DFG, USFWS, and BCDC for each year in which monitoring of the development of seasonal wetland and emergent marsh areas is conducted. If the rate, quality, and quantity of created habitat are not meeting restoration goals at the end of the 5-year period, the sponsoring agencies will consult with the above agencies as regards to further monitoring and potential corrective actions.

Maintenance and Adaptive Management

Corrective actions in response to problems identified when monitoring biological resources conditions may entail either maintenance activities or adaptive management activities. The distinction between these two categories of activities will be developed in greater depth in the detailed Monitoring and Adaptive Management Plan and the OMRRR Manual, respectively. The focus in non-tidal areas will be directed towards encouraging appropriate native plant species and minimizing the presence of exotic plant species of particular concern such as non-native cordgrass, pampas grass, broom, and yellow star thistle. Corrective techniques may include mowing, burning, manual removal of unwanted plants, and herbicides (approved by the federal Environmental Protection Agency for use in wetlands) if needed. Mowing and manual removal have been effective so far at suppressing unwanted upland plant species at the Sonoma Baylands project, and herbicides have not been necessary. Any vegetation-control efforts will need to be carefully planned and executed to avoid negative impacts on adjacent habitats and wildlife. Control of non-native predators (feral cats and/or red foxes) may also be needed. A plan for controlling noxious plant species and non-native predators will developed in coordination with California Department of Fish and Game and U. S. Fish and Wildlife Service.

Biological maintenance in tidal areas will primarily be passive, with natural processes allowed to gradually restore habitats. However, tidal areas (and uplands) may be invaded by the non-native perennial pepperweed (*Lepidium latifolium*). Control of this plant is uncertain and cannot be guaranteed. Herbicides would most likely be required in any attempt to control this species, should it invade the site.

PUBLIC HEALTH (MOSQUITO BREEDING HABITAT)

Monitoring and management activities associated with potential creation of mosquito breeding habitat will be coordinated with the Marin-Sonoma Mosquito and Vector Control District. Activities may include: development and implementation of water management strategies to reduce site suitability for mosquito breeding (e.g., introduction of saline water); air and ground applications of Bti (*Bacillus thurigiensis var. israelensis*), methoprene growth regulators, or other Environmental Protection Agency approved pesticides as needed; ongoing monitoring of larval and adult mosquito populations, water quality, and vegetation density, and implementation of control and management measures as determined by MSMVCD.

ADAPTIVE MANAGEMENT

Adaptive management is a term that has been used to mean various things. As used here, it is an approach to resource management in which management goals remain the same, but management objectives and techniques may be modified in response to feedback (such as monitoring results) from the system being managed. Adaptive management recognizes that human knowledge regarding biological and physical systems is limited and that these systems may not always behave as expected. When a management or restoration project is to be implemented but there is some uncertainty regarding the response of the system to particular actions, adaptive management provides a way for management actions to respond to feedback from the system being managed. Adaptive management will be implemented if specific restoration standards are not met or if it appears that actual conditions will diverge sufficiently far from intended conditions to threaten the achievement of overall project goals. Funding for adaptive management will be included in the project cost estimates so that this option will be available in the future if needed.

Should the development of the site fail to meet quantitative standards to be stated in the detailed monitoring plan, action to correct these shortfalls will be undertaken if such action could reasonably be expected to assist in the achievement of these standards. Corrective action could include vegetation management, predator management, topographic modifications such as creation of or enlargement of channels, or levee repairs or modifications. Once corrective actions are taken, they become part of the completed project and will be maintained during and after the 13-year monitoring period as prescribed by the O&M manual.